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A COST OF CAPITAL AND CAPITAL BUDGETING
DECISION MODEL RELATED TO NEW,
SMALL, HIGH TECHNOLOGY
CORPORATIONS

A Research Paper
Presented To
the Faculty of the Graduate School of Business
Rochester Institute of Technology

In Partial Fulfillment
of the Requirements for the Degree
Master of Business Administration

by
Bruce R. Robinson

January 1973

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CHAPTER I

THE PROBLEM AND DEFINITION OF A NEW SMALL FIRM

Much has been written relative to capital budgeting techniques and the cost of capital as separate decisions. In a new small firm these two decisions become inextricably related.

I. THE PROBLEM

The recent cutback in U.S. Military Defense spending has freed many engineers and scientist to form their own small businesses to perpetuate their technological employment. In reviewing their plight I have found these new ventures have developed, or are in the process of developing, new highly technical products and services such as data recorders, communications receivers, integrated circuitry, etc. Many of these products or services are reported to have significant technical advantages over those currently available. In a few cases the proposed products are novel enough to be considered capable of filling entirely new market needs. Also typical of these operations is their attempt to provide small contract design development services to large industry and government agencies to provide the capital necessary to remain in business and support development of the aforementioned commercial products. The initial capital for these firms consists primarily of equity contributions of the entrepreneurs, close friends, family and occasionally SBA backed loans. Many of these firms in the

Rochester metropolitan area are about to survive their first several years of operation, have completed their new commercial product development and now must raise capital to introduce these products and initiate manufacturing. The problem is to raise this capital in a way that will optimize the firm's capital structure in light of the new product risks and the component cost of capital.

II. ORGANIZATION OF PAPER

In this paper I have described a simple effective technique for determining the risk characteristics of the expected return on a new capital expenditure. I have defined the component costs of capital and demonstrated how the new venture capital structure can be arranged to satisfy the risk utility function of the owner entrepreneurs in light of the expected returns. I have presented preliminary research which was performed to establish initial estimates of the costs of the various components of the capital structure. This research was performed in up-state New York at the time of this study and is applicable to firms conforming to the definition in Section III of Chapter I. These estimates were then used in a hypothetical case to demonstrate the applicability of the study and theory.

III. A DEFINITION OF THE NEW SMALL FIRM

For the purpose of this paper I will limit my definition of a new small firm to one having the following characteristics:

- 1) Annual sales of less than \$10 million/year
- 2) Employing less than 250 people

3) Based on new technological product developments or services

4) Incorporated and operating for less than five years

Though somewhat restricted, this definition is applicable to many new ventures entered into by engineers and scientists and conforms to the SBA definition of a small business.

CHAPTER II

COST OF CAPITAL AND THE NEW PRODUCT

INVESTMENT DECISION WITH RISK

The cost of capital to the firm is the effective rate the firm must pay to acquire funds for growth and development. It will be considered as that discount rate with the property that an investment made above this rate will raise the value of the firm in the eyes of the owners.¹ Its major application is in deciding whether a proposed new venture will be profitable. Even though there is considerable discussion about the means of arriving at this cost of capital and its component characteristics there is little doubt that such a rate does exist and could be used to evaluate investment alternatives.

I. THE NEW PRODUCT INVESTMENT AND RISK ANALYSIS TECHNIQUE

The new technologically based firm must convince supporters and investors that its new ventures would produce returns on their investment and would adequately compensate for the investment risk. This can also be stated as: the firm must assure the investors that the capital expenditures to be undertaken by the firm would have an expected rate of return at least as high as the cost of capital to the business.² In this sense, the cost of capital would include compensation

¹M. J. Gordon, The Investment, Financing and Valuation of the Corporation, p. 218.

²Roland I. Robinson, Financing the Dynamic Small Firm., p. 56.

to the investor for risk associated with the new venture. This generally accepted requirement of the firm may be stated mathematically as:

$$R_r \geq R_c$$

where: R_r is the expected value of the rate of return on the investment considered

R_c is the cost of capital

This rate of return R_r is generally accepted to be that discount rate that will permit equating future (after tax) income with present cash outlays required for the new venture. The component variables associated with calculating a given rate of return on the new venture are usually assigned one value and therefore yield one calculated return. To more thoroughly evaluate a proposed venture a minimum, average, or maximum value for each component variable can be estimated and each value assigned likelihood of occurrence. This variable permits calculating a probability distribution of possible returns on an investment. To calculate this probability distribution of R_r for the proposed new venture one must first estimate the following factors:³

³David B. Hertz, Risk Analysis in Capital Investment, Archer and D'Ambrosio, Theory of Business Finance, p. 400.

	Minimum Qty Likelihood		Average Qty Likelihood		Maximum Qty Likelihood	
Annual Sales less Variable Costs and Estimated taxes	A ₁	V ₁	A ₂	V ₂	A ₃	V ₃
Fixed Annual Operating Costs	B ₁	W ₁	B ₂	W ₂	B ₃	W ₃
Residual Value of Investment	C ₁	X ₁	C ₂	X ₂	C ₃	X ₃
Useful Life of Investment	D ₁	Y ₁	D ₂	Y ₂	D ₃	Y ₃
Initial Investment	E ₁	Z ₁	E ₂	Z ₂	E ₃	Z ₃

Where: 1) The annual sales less variable costs and estimated taxes (A) would typically be given by:

sales revenue - manufacturing costs (labor & materials) - variable selling expense

- variable overhead costs - variable facilities costs

- estimated taxes

- 2) Fixed Annual Operating Costs (B) include the costs for non-variable items related to plant, personnel and equipment required to sustain activity on the new venture.
- 3) Residual Value of Investment (C) is the estimated market value of all materials acquired for the project with the initial investment capital. This should include estimates for depreciation and capital gains tax.

- 4) Useful Life of Investment (D) is that time period prior to technical obsolescence of the product or in some cases market saturation.
- 5) Initial Investment (E) is that totality of funds required to initiate and sustain the new venture at its inception.
- 6) V, W, X, Y, and Z are the related probabilities of occurrence of each variable A, B, C, D, and E respectively.

To calculate the internal rate of return one equates cost of investment outlay E with the present value of expected future receipts as given

by:

$$E_j = \sum_{t=1}^{D_j} \frac{A_j - B_j}{(1 + R_r)^t} + \frac{C_j}{(1 + R_r)^{D_j}}$$

$j = 1, 2, \text{ or } 3$ minimum, average, or maximum value
subscripts

Where: $R_r =$ Internal rate of return
 $E_j =$ The cost of investment outlay
 $A_j - B_j =$ The annual receipts expected from the venture
 $D_j =$ Useful life of the investment, usually in years
 $C_j =$ Residual value of investment

This calculation would require selection of one condition (minimum, average, and maximum) for each of five variables out of three which would combine to give $1^C_3 \cdot 1^C_3 \cdot 1^C_3 \cdot 1^C_3 \cdot 1^C_3 = 3^5 = 243$ combinations. Therefore 243 independent calculations would be required to obtain the distribution curve of expected returns. I have concluded this would require the use of a computer to arrive at the desired distribution in a reasonable amount of time. For each one of these 243 outcomes I assign the probability ($n_t = V_j \cdot W_j \cdot X_j \cdot Y_j \cdot Z_j$) associated with each outcome.

NOTE: It is obvious that the product will go through a product life cycle as with all high technology products. It could be argued that assuming some constant estimate of each financial variable renders the analysis less useful. This approach was considered and discarded because it is somewhat compensated for in the variability attached to each piece of data and further the shape of the product life cycle is all but impossible to predict except in the general case.

Each calculated internal rate of return R_r will then have an associated probability of occurring n_t . If one classifies the internal rates of return into equal return classes and totals the n_t probabilities associated with each return in each class it is possible to plot a histogram probability distribution or probability function $f(R_r)$ as shown below.*

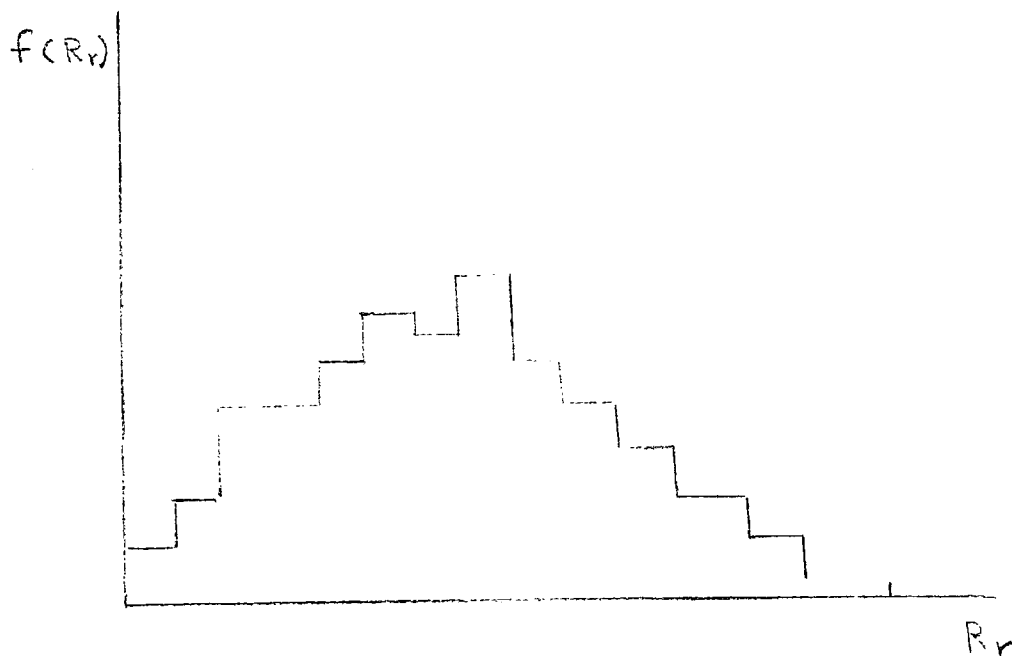


Figure #1 Return Probability Function

Summing this distribution from 0 to ∞ one can derive the distribution function or cumulative distribution $F(R_r)$ of the discrete random variable R_r as given by:
$$F(R_r) = \sum_{R_r \leq x} f(R_r) \text{ for } 0 \leq x \leq \infty$$

*The equal return classes should be selected to provide the desired distribution resolution.

This internal rate of return cumulative distribution can be plotted as a discontinuous function (step function) as shown below.

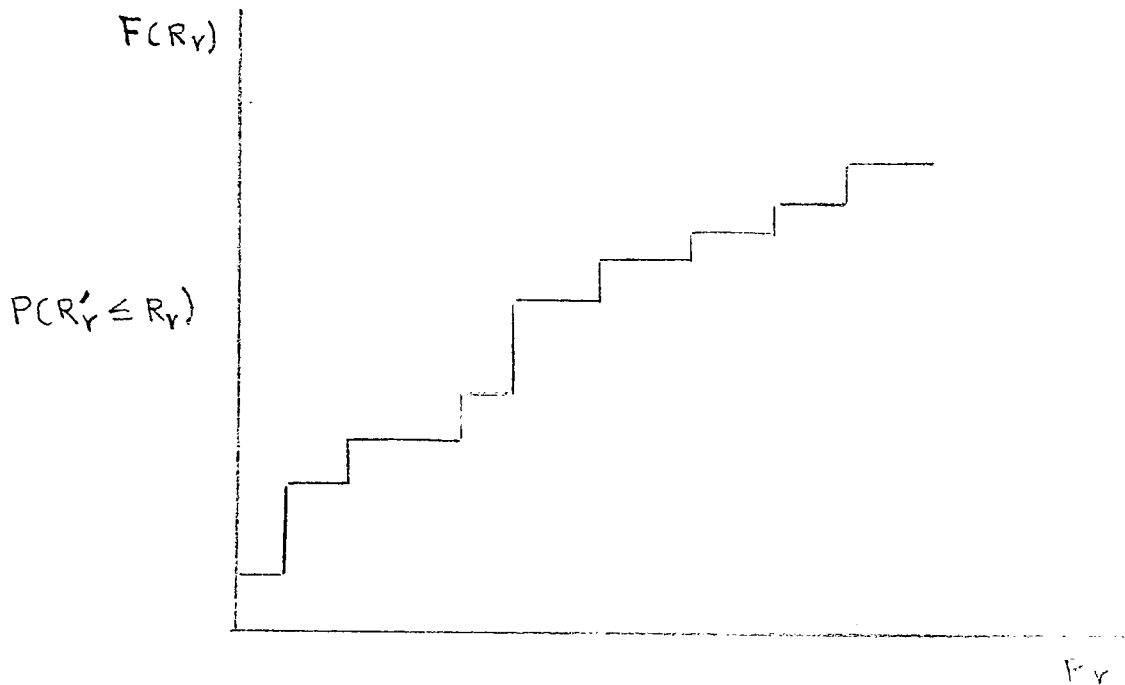


Figure #2 Return Cumulative Probability Function

This curve indicates the probability that the actual return R_r on the investment opportunity will be less than any rate of return chosen on the abscissa (R_r). It should be noted that at all points of discontinuity on this curve the greater of the two probability values should be used.

The new venture can be analyzed in light of the above probability distributions. The managers could adjust their financial structure in light of these curves to satisfy the firm's risk utility function, as will be described later.

II. A COMPARISON TO SIMILAR TECHNIQUES

It is worthwhile to note that some scholars in the field of finance have recommended the decision rule; accept only those investments which have a rate of return greater than the cost of capital.⁴ I feel this rule is negligent. It essentially ignores the risk associated with each projected return. They go on to note that sometimes the firm should accept investments returning less than the overall cost of capital if the investment reduces the overall risk of the firm.⁵ This introduces an intuitive risk correction to the data after many too risky ventures may have been undertaken. The technique I propose to use will arrive at the return on investment which meets with the utility function of the corporation owners. Thus, risk factors are automatically taken into account in the analysis of each investment.

⁴Harold J. Bierman, Jr., Financial Policy Decisions, p. 81.

⁵Ibid, p. 81.

CHAPTER III

CAPITAL STRUCTURE THEORY

There have been many attempts to establish a theory that can be used to predict the optimum capital structure. The most revolutionary approach to the theory of capital structure was set forth by Modigliani and Miller where they concluded that the cost of capital was a constant, regardless of the firm's debt-equity structure. Their theory made the assumption that the stockholder could compensate for corporate debt risks through modifying his personal portfolio (arbitrage). This assumption fails since personal leverage is not a perfect substitute for corporate leverage.⁶ Also, they assumed the firm could be classified in some well defined risk class and neglected taxes. Even after they corrected for tax effects, their theory maintained that beyond a certain debt level the required stockholder return would decrease. This runs contrary to our notion that more risk should entail more return. They also assume that the P/E ratio of stock is unaffected up to some conventional debt limit which was conveniently left undefined.⁷

The more traditional economic approach to the cost of capital assumes that the firm should push its investments to the point where

⁶J. Fred Weston, "A Test of Cost of Capital Propositions", reprinted in Archer and D'Ambrosio, The Theory of Business Finance, p. 205.

⁷Ibid, p. 204.

the marginal return is equal to the marginal cost of capital. The originators of this concept consider maximizing the return to the stockholder and maximizing the value of the firm (discounted earnings) as criterion for establishing the optimal capital structure. Under conditions of certainty this approach is able to define an optimal cost of capital and capital structure. However, it proves inadequate when uncertainty of cash flow is considered. The proponents of this technique add risk premiums, super premiums, risk discounts, and more to their equations to adjust for risk but leave the level of these adjustments somewhat nebulous.⁸

I. PROPOSED MODIFIED THEORY

For the proposed new small firm capital structure theory, I will make several assumptions:

1. There is no single long range optimal structure due to the rapidly changing characteristics of the firm's earnings. Each investment must be considered in light of the current cost of capital.
2. The firm is controlled by one or several individuals who can alter the capital structure to compensate for changing risk and the owners' risk utility function.
3. The outside equity capital investor in the small firm is primarily concerned with growth opportunities as evidenced by increased value of the firm.

⁸Franco Modigliani and Merton H. Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment", Reprinted in: Archer, and D'Ambrosio, The Theory of Business Finance, p. 126.

4. At worse, the small firm can obtain debt financing from SBA backed sources for one to ten year terms up to 1/2 the total capital in the firm.
5. No debt will be held by equity holders in the firm.
6. Debt limits of the firm's capital structure will be established by the money market not the capital market.

The proposed modified theory is based on building a capital structure and selecting investments which yield a return greater than the associated cost of capital and commensurate with the owners' risk utility function. This is accomplished by developing a probability distribution of the rate of return expected on a new venture and comparing this curve with the various component costs of capital. If the comparison indicates that the return on an investment is greater than the cost of capital with a likelihood of loss compatible with the owners' risk utility function the investment should be made.

As shown in Figure #3, the owner could theoretically generate a continuous probability distribution $f(R_r)$ of the expected rates of return on a new venture. The probability that any rate of return R'_r on the new venture will be less than a selected abscissa value R_r is given by:

$$P(R'_r \leq R_r) = \int_0^{R_r} f(R_r)$$

If one substitutes the cost of capital (R_c) for the selected abscissa value, the probability that the new venture will return less than the cost of capital is similarly given by:

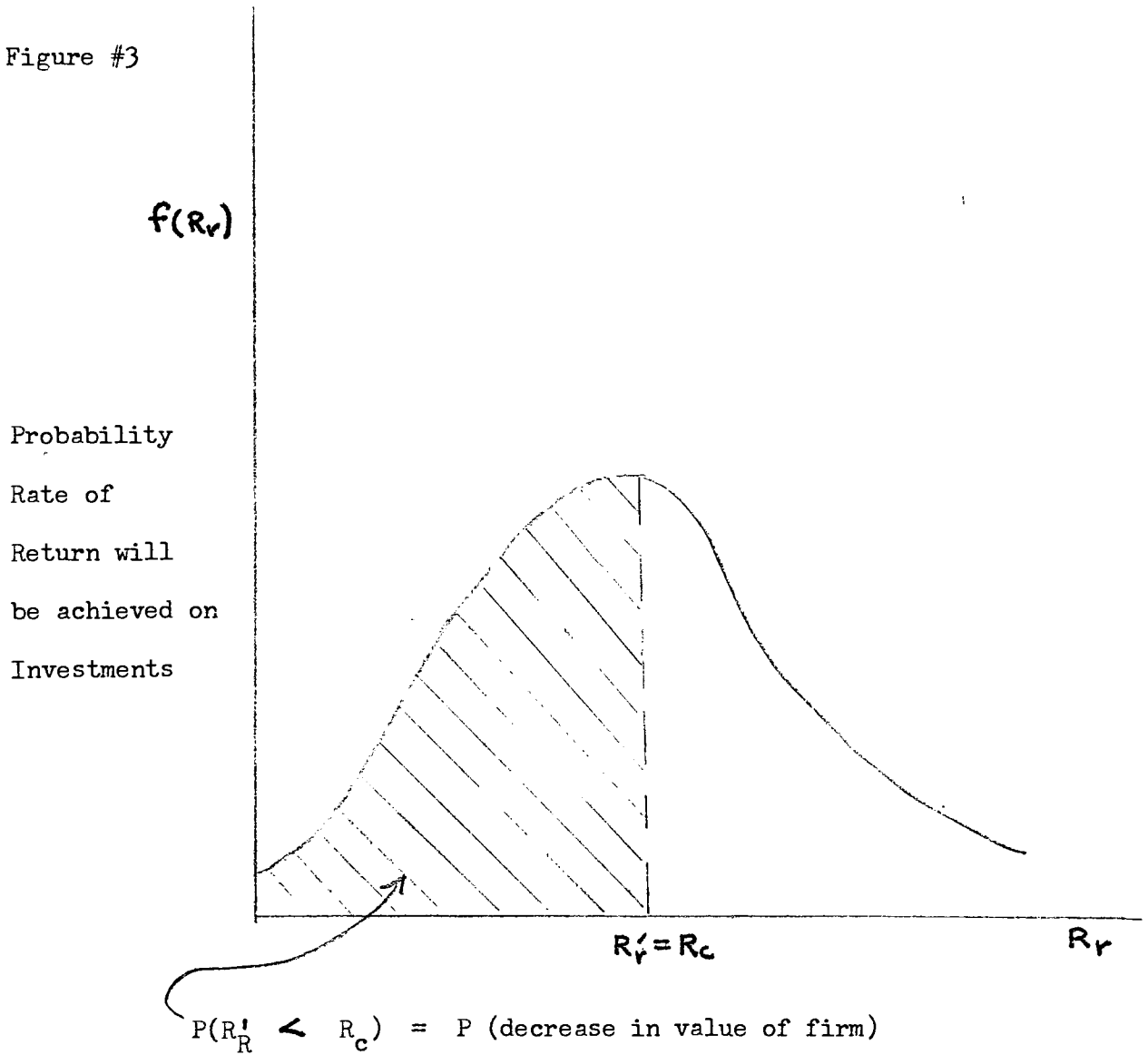
$$P(R_r' \leq R_c) = \int_0^{R_c} f(R_r)$$

Since this is equivalent to the probability that the firm will decrease in value we can state:

$$P(\text{decrease in value of firm}) = \int_0^{R_c} f(R_r)$$

It is this probability of a decrease in the value of the firm which must be less than that which is defined by the owners' risk utility function.

Figure #3



Where: Decrease in value of firm is defined as any return on investments that is less than the controlling investors expect.

Looking at the weighted average cost of capital as given by:⁹

$$R_c = W_L C_L + W_D C_D + W_P C_P + W_R C_R + W_E C_E$$

Where: R_c = weighted average cost of capital

C_L = cost of trade credit

C_D = cost of debt capital

C_P = cost of preferred stock

C_R = cost of retained earnings

C_E = cost of external equity

W = % of each type of capital in the capital structure

My research indicates retained earnings, equity and debt are the prime sources of capital. I will consider the characteristics of these costs individually at a later point in the paper. The cost of capital of the small firm is now given by:

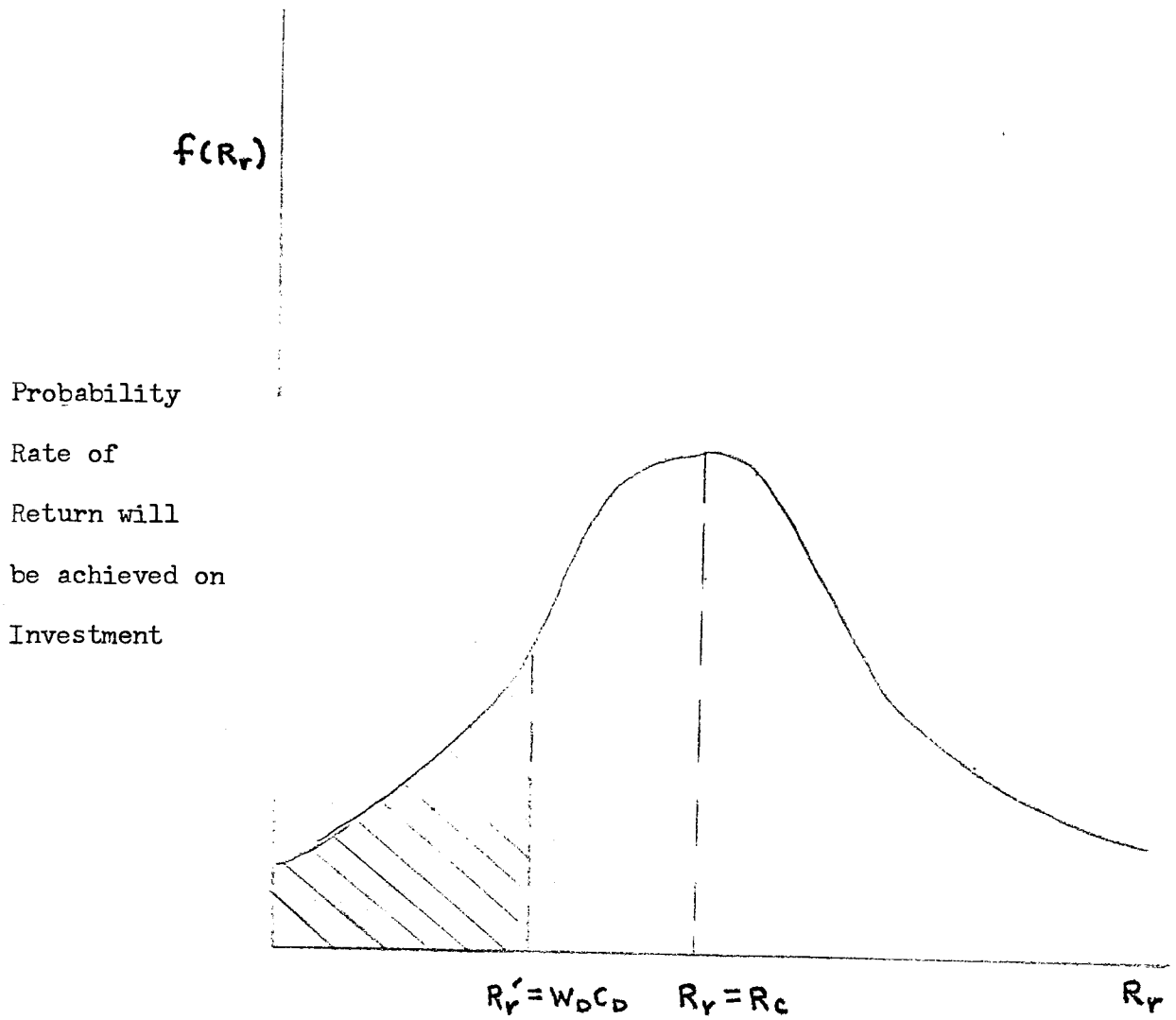
$$R_c = W_D C_D + W_R C_R + W_E C_E$$

If we assume that $C_D < C_R < C_E$. The minimum cost of capital is that cost that first maximizes the use of debt capital (C_D) consistent with the owners' desire for safety from defaulting on his debt, then maximizes retained earnings (C_R) consistent with his growth expectations for the firm. Finally, equity capital should be used to satisfy the firm's remaining capital needs.

With reference to Figure #4, the owners of the firm would consider using the expected return on investment curve to determine the risk associated with any given amount of debt. This amount of debt can be plotted at some value $W_D C_D$ on the abscissa of the expected return curve.

⁹Eugene F. Brigham, and Keith V. Smith, Cost of Capital to the Small Firm, p. 175.

Figure #4



$$P(R_r' < W_D C_D) = P(\text{default}) = \text{Risk} = \int_0^{W_D C_D} f(R_r)$$

The probabilities of potential default on this amount of debt is then given by the area under the probability curve from 0 to $W_D C_D$ or:

$$P(\text{default}) = P(R'_r < W_D C_D) = \int_0^{W_D C_D} f(R)$$

This can be explained by analyzing the capital structure again. The first investors not to be satisfied are the equity investors if we assume solvency is of prime importance. Since the cost of retained earnings and equity capital are directly determined by their level of satisfaction in the case where R_r goes below R_c the return to investors through growth or dividends goes to zero at $R'_r = W_D C_D$ and all earnings go to service debt. The probability that the debt charges will be covered is not really affected by the amount of retained earnings or equity investment in the new firm, it is now reduced to:

$$P(\text{debt coverage}) = 1 - P(R'_r \leq W_D C_D)$$

This assumes the situation where retained earnings or equity funds are used to cover debt charges is totally unacceptable.

The amount of debt used is then the maximum amount consistent with the owner managers' risk utility function associated with defaulting on loans or covering loans from other sources. The amount of risk for each level of debt in the capital structure is then established by the expected rate of return curve as previously demonstrated.

As noted earlier, retained earnings should be used in amounts consistent with the growth objectives of the firm.¹⁰ According to Brigham and Smith the percentage of equity that must be obtained through external sources is given by:¹¹

$$\frac{W_E}{W_E + W_R} = \frac{G - R}{G} \quad : \quad G > R$$

where: W_E = percent of common stockholders' equity in the capital structure
 W_R = percent of retained earnings in the capital structure
 G = desired asset growth rate
 R = the after tax return projected on existing equity

If $R > G$ the firm is able to generate sufficient funds internally. If $R < G$ it becomes more difficult to raise new equity capital. If we assume that the firm is in its first year of operation, $W_R \rightarrow 0$. Furthermore, to be consistent with our original assumptions about growth it should be evident that all retained earnings should be reinvested in the new venture during its first few years of operation.

To summarize, the firm should acquire as much low cost debt as possible consistent with the owners managers' risk utility function as determined by projected earnings for the following year. All retained earnings should

¹⁰Brigham and Smith, Op. Cit., p. 187.

¹¹Ibid, p. 187.

be made available for reinvestment, if growth is the assumed prime objective of the new venture and additional equity acquired only as necessary to meet additional investment needs. This iterative approach to optimizing the capital structure of the new firm should initially yield close to the minimum practical cost of capital consistent with its growth and risk objectives. Furthermore, this approach will readily point out which investment alternatives are not consistent with the firm's growth and risk objectives even at the optimum cost of capital.

II. COST OF DEBT THEORY

If we adhere to the Modigliani and Miller propositions previously discarded, we would arrive at a cost of debt given by:¹²

$$C_D = \alpha_t (1 - t_c)$$

where: α_t = after tax discount rate applied by the investing public to the stock of an unlevered firm in the same risk class

t_c = corporate tax rate

C_D = effective cost of debt to the firm

However, there are numerous assumptions associated with this estimate of the cost of debt that must be noted to vigorously accept and apply this to our decision model. These assumptions are:

1. The effective cost of debt is that return it must earn in order not to alter shareholder welfare as indicated by stock price.
2. Some means of measuring the after tax discount rate applied by investors to the stock of unlevered firms in the same risk class exists.
3. There is a market for the stock which sets a price to earnings' ratio and its investors' exercise arbitrage fully to compensate for varying corporate debt ratios.

¹²Wilbur G. Lewellen, Cost of Capital, p. 44.

For new ventures, the stock price is often a highly volatile level determined by a rather small market (if a market exists) sample based on the initial prospectus of the firm or recent earnings' information. There is no well defined risk class associated with the new firm and therefore there is little chance of measuring the after tax discount rate applied by investors to the stock. Therefore it is evident that an application of this cost technique to the cost of debt is not appropriate for our model.

The more conventional approach to the cost of debt capital is the after tax, after floatation cost, effective rate the firm must pay for debt. It is defined explicitly as:

"The rate of return that must be earned on debt-financed investments in order to keep unchanged the earnings available to common stockholders."¹³

This turns out to be the after tax effective yield on the debt. If we let D' be the rate of interest on the debt adjusted for acquisition premiums or discounts and t_c to equal to the corporate tax rate we have

$$C_D = D' (1 - t_c)$$

It is this cost of debt, which is compensated for the tax deductability of interest payments, that will be used as the true cost of debt in the model for the new venture. This makes no assumptions pertaining to the effect of debt on the stockholders or the stockholders' valuation of the firm's capital. These factors are considered in the overall model and would be double counted if considered here also.

¹³J. Fred Weston, Managerial Finance, p. 341.

III. COST OF RETAINED EARNINGS THEORY

Again starting with the Modigliani and Miller approach to the cost of capital they conclude that the cost of retained earnings is:

"Simply that profit rate which will raise the price of the firm's stock by enough that after capital gains taxes are deducted, its shareholders are as well off as if they had received a dividend payment instead and paid the associated income tax."¹⁴

This compares reasonably well with the conventional argument that:

"The cost of retained earnings, or the return that might be earned on investments financed by retained earnings is equal to the rate of return that investors expect to receive on the stock."¹⁵

However, Lewellen, in his expansion of the Modigliani and Miller approach arrives at the following cost of retained earnings:

$$C_R = \frac{\alpha_t(1 - t_p)}{(1 - t_g)}$$

where: α_t = same as in prior debt formula
 t_p = personal tax rate of investor
 t_g = capital gains tax of investor

¹⁴Lewellen, Cost of Capital, p. 65.

¹⁵J. Fred Weston, Managerial Finance, p. 345.

The α_t term still requires the definition of a public discount rate applied to the common stock in an unlevered firm of the same risk class. Again this is difficult if not impossible to obtain for the new small firm. However, the ratio $\frac{(1 - t_p)}{(1 - t_g)}$ defines the opportunity ratio of tax advantages to the investor which is different than more conventional expressions for retained earnings. Assuming that funds are available for dividends, if the stockholder takes the dividend he must pay personal taxes on that dividend at a rate t_p . If the investor leaves funds in the firm in the form of retained earnings he must pay taxes ultimately on these retained earnings in the form of capital gains on his sales of stock in the firm. The opportunity cost associated with retained earnings to the firm would therefore decrease as personal taxes increase and increase as a function of capital gains tax. This ratio therefore more accurately describes the opportunity cost associated with retained earnings than the suggested $(1 - t_g)$ factor of Brigham and Smith in the Cost of Capital for the Small Firm.¹⁶ The Brigham and Smith factor indicates that as the capital gains tax were increased the cost of capital to the firm decreases. However this does not logically follow. As the capital gains tax increased the investor might logically want the firm to give him more dividends and put a higher premium on having the firm retained earnings. However, as his personal taxes increase he might put less premium on receiving dividends and more premium on receiving capital gains as described by Lewellen's ratio.

¹⁶Brigham and Smith, Op. Cit., p. 188.

A combined expression for the cost of retained earnings can be formulated as:

$$C_R = C'_E \left(\frac{1 - t_p}{1 - t_g} \right)$$

$$\text{If } t_p > t_g \quad C_R < C'_E$$

$$t_p < t_g \quad C_R > C'_E$$

Where:

C'_E = cost of common equity less flotation cost factors

t_p = investor tax rate on dividends

t_g = investor capital gains tax

As with the more conventional approach, this cost is defined in terms of the expected return on common stock and is defined in the next section as the cost of common stock prior to flotation costs.

IV. COST OF EQUITY THEORY

Lewellen interprets the Modigliani and Miller approach to cost of equity capital as:¹⁷

$$C_E = \frac{\alpha_t}{1 - b}$$

where: C_E = the cost of equity capital

α_t = the after tax discount rate applied by the investing public to the stock of an unlevered firm in the same risk class

b = discount factor applied due to flotation costs, etc.

Again, as stated previously, α_t is difficult if not impossible to obtain and carries with it several assumptions not applicable to the new small firm, as noted previously.

However, some estimate of the rate of return investors expect on their equity is required. Gordon has most closely approximated this as:¹⁸

$$C_E = \frac{\text{dividend}}{\text{price}} + \text{expected growth} = \frac{D}{P} + g$$

Where: C_E = the rate of return investors expect on their capital

D = annual dividend payment

P = current price (some say it should be average)

g = expected growth

¹⁷ Lewellen, Op. Cit., p. 72.

¹⁸ J. Fred Weston, Op. Cit., p. 407.

Several areas of controversy exist over the use of Gordon's model. First, he capitalizes an infinite stream of dividends to arrive at this expression. This assumes some priori knowledge of the future dividend payments. This is seldom available. The model also assumes all financing is done with retained earnings. However, in a new venture dividends are very unlikely to occur or be expected by the investors for the first few years. This reduces Gordon's model to:

$$C_E = g$$

It therefore remains to be determined what the investors' after tax expected return through growth will be with the new venture and the cost of equity capital can be written as:

$$C_E = \frac{g}{1 - b}$$

for the new firm. Where $1 - b$ accounts for flotation costs.

Equity capital in the new firm is acquired from both "inside" investors and outside investors and each type of capital has its own peculiar cost characteristics. The inside investor is interested in control of the firm to assure himself of control over his investment. Another way of looking at the associated cost of capital is by relating the percent control to the expected earnings. The cost of such capital may be written as:

$$C'_E = \left(\frac{\text{Projected Earnings}}{\text{Insiders' Contribution}} \right) \% \text{ of ownership}$$

¹⁹Roland Robinson, Financing the Dynamic Small Firm, p. 57.

At first, this may seem to be a myopic view of the inside investors' intentions. However, it can be reduced to our previous cost of equity expression where we understand that the change in projected earnings based on the insiders' investment is essentially our definition of growth and the percent ownership is his share of that growth. In this case, the $1-b$ term goes to 1 as b goes to zero since there should be negligible costs associated with inside investment of funds.

The inside investor can dilute the value of the common stockholders' equity in a firm. The initial sale of large portions of the common stock to inside investors may make future public offerings less attractive. For example, if the owners of the firm decide to hold 51% of the firm's stock for a contribution of 1% of the total equity of the firm the cost of the capital from this source will be calculated as: For a given return on total capital these individuals will in essence take $1/2$ the earnings due other investors if there were equal distribution of stock per invested dollar. This is often explained by making inside investors essential to the success of the new firm and their payment is for this contribution. This brings out the point that for every growth by a factor of 2 expected by the outside investor the inside investor may expect a multiple of this number. Therefore growth in earnings (g) as it is defined in the cost of equity equation can vary considerably depending on the sophistication of the investor.

In this sense the growth in earnings required by the inside investor to realize his desired growth in investment is multiplied by the discount

factor by which his stock price was reduced and the common stockholders' investment is directly related to the firm's growth in earnings. This is considered more rigorously in the Appendix E.

In summary we will use the following definitions of the costs of the various components of capital in the new ventures' capital structure:

$$C_D = D'(1 - t_c)$$

$$C_R = \frac{g(1 - t_p)}{(1 - t_g)}$$

$$C_E = \frac{g}{1 - b}$$

and the total cost of capital will then be given as:

$$R_C = W_D D'(1 - t_c) + W_R g \left(\frac{1 - t_p}{1 - t_g} \right) + W_E g$$

$$R_C = W_D D'(1 - t_c) + g \left(W_R \left(\frac{1 - t_p}{1 - t_g} \right) + W_E \right)$$

Based on this model attempts will be made to calculate typical costs of capital for the specified type of new small firm.

CHAPTER IV

COST OF CAPITAL FOR LOCAL

SMALL BUSINESSES

The objective of this research is to obtain accurate information on the cost of capital for new, small, high technology firms. Such information can then be used to describe a composite firm representative of the firm in this risk class. This composite firms capital structure can then be used in conjunction with the internal rate of return versus risk computer program to evaluate the feasibility of new ventures.

I. DESCRIPTION OF RESEARCH AND ANALYSIS

The firms studied were limited to upstate New York to permit close contact with financial information. This was accomplished by selecting all local firms from the over-the-counter weekly listing in the Upstate Business Journal. After initial selection, further research was performed to insure that the selected firms fit my previously defined criteria for a new, small, high technology business. This was accomplished through reviewing the local business papers from January 1, 1972. Where this information was not available by such means, calls or visits were made to the firm in question. In this manner, I found 25 out of a possible 73 firms that met the requirements of this study.

Letters were written to the financial officer of each of the 25 firms requesting their most recent prospectus and latest financial summary. A sample of this letter is shown in Appendix A. Thirteen positive responses and one negative response were received in response to the letter. This was followed by a telephone call or visit where necessary to clarify the financial data. These results permitted approximating the cost of capital and capital structure for the responding firms.

Realizing that many of the firms to be studied were financed by venture capital businesses, reviews were made of current business literature to locate estimates of the expectations of venture capital firms. The 1971 publication of the Boston College School of Management entitled "Venture Capital, a Guidebook for New Enterprises" was consulted. It presented venture capital information on 99 venture capital firms. It was written for the New England Regional Commission yet included venture capital corporations throughout the North Eastern United States. This source provided quantitative information on the expectations of 17 venture capital firms. Quantitative information on RAND Capital Corporation of Buffalo was also located from local news publications.

Finally, the Upstate Business Journal over-the-counter biweekly listings were used to plot the stock performance of the 25 firms selected. These plots were made over a nine month period from January 1972 to October 1972 and used to interpret investors' expectations based on market performance of stocks in the appropriate risk class. The nine month period was a subjective limitation imposed by the initial publication of the Upstate Business Journal.

The sample mean and standard deviation on all data was calculated using:²⁰

$$\text{Sample Mean} = \bar{X} = \frac{\sum_{j=1}^N x_j}{N}$$

$$\text{Standard Deviation} = S = \sqrt{\frac{\sum_{j=1}^N (x_j - \bar{X})^2}{N}}$$

Where: N = Number of samples

The accuracy of this estimate of the assumed normally distributed population mean was tested using the "students" t distribution since the sample sizes were less than thirty. The confidence limits for the population mean are given by:²¹

$$\bar{X} \pm t_c \left(\frac{S}{N-1} \right)$$

where: t_c = critical values or confidence coefficients

The results for each area of research are presented in the following text and reduced with analysis on a functional basis.

²⁰ Murray R. Spiegel, Statistics, p. 70.

²¹ Spiegel, Op. Cit., p. 189.

II. COST OF EQUITY AND RETAINED EARNINGS FOR THE SURVEYED FIRMS

As noted in the preceding discussions on the cost of stockholders' equity (C_E), this cost is directly proportional to stockholders' expectations. For the purpose of this study, these stockholders' expectations have been divided into two classifications. The first is the inside venture capital investor expectations and the second is the over-the-counter securities and new issue investors' expectations.

The venture capital investor usually invests "inside" money at either the start of a new venture or at a point when the new firm's products are developed and ready to manufacture and sell. As noted previously, their expected return is often higher than "outside" investors and is reflected in the total cost of equity by some factor K due to the higher risk factor. This factor may be arrived at through sale of inside stock at some discount over the stock publicly offered as shown in Appendix E. However, this discount decreases the return to "outside" investors which is equivalent to increasing "inside" investors' return. Therefore, the venture capital investors' expectations are taken directly at face value as well as the "outside" investors' expectations based on stock performance. The average K factor will be based on the average data.

As shown on the following page, information on eighteen venture capital firms has been acquired. Their expected return on invested capital ranges from 12% per year to over 100% peryear. The average of all expectations is 42% per year return on invested capital. This result appears to be representative of the industry based on the small variability in the data obtained. However, it is further recognized that this sample size is indeterminately small compared to the size of the total population.

VENTURE CAPITAL FIRMS

<u>Source</u>	<u>Expected Return</u>
1. Albert J. Kelley, Frank B. Campanella, John McKiernan, <u>Vent e Capital</u> Authors Estimate p. .	25 - 40%/year
2. First Connecticut SBIC - p. 41*	12%/year
3. Burgess & Leith - p. 66*	5 times in 5 years (38%/year)
4. Creative Resources, Inc. p. 68*	10 times in inv. period
5. Explorer Fund, Inc. p. 70*	5 - 10 times in 5 years (38%/year)
6. Federal Street Capital Corp. p. 71*	35 - 50%/year 2 times in 2 years
7. Financial Investors of Boston, Inc. p. 72*	40 - 50%/year
8. Gardner & Preston Moss, Inc. p. 76*	20 - 30%/year
9. Kidder, Peabody & Co., Inc. p. 81*	10 times in 3 - 5 years (75%/year)
10. Koch Venture Capital, Inc. p. 82*	10 times in 5 years (75%/year)
11. Paine Venture Fund, p. 87*	5 times in 5 years (38%/year)
12. Resources Technology Management Co. p. 88*	40%/year
13. Technology Search Associates, p. 89*	40%/year
14. Baker Technology Associates p. 96*	10 times in inv. period
15. Carr Management Company p. 100*	10 times in 7 years (40%/year)
16. Diebold Venture Capital p. 108*	5 - 8 times in 3-5 years (60%/year)
17. Neuwirth Financial p. 121*	30%/year
18. Rand Capital Corp. ** Buffalo, New York	5 times in 5 years (38%/year)

* From Albert J. Kelley, Frank B. Campanella, John McKiernan,
Venture Capital.

** From Upstate Business Journal., May 2, 1972, p. 10.

Since the sample size for the venture capital data is less than 30, and if we assume the population very large and normally distributed, the accuracy of the estimated mean will be evaluated based on the "students" t distribution with $\bar{X} = 42$ and $s = 16.27$.

Within specified limits of confidence the population mean can be estimated by:²²

$$-t_{\text{conf. limit}} < \frac{42 - \mu}{16.27} \sqrt{15} < t_{\text{conf. limit}}$$

or μ lies in the interval:

$$42 - t_{\text{conf. limit}} \left(\frac{16.27}{\sqrt{15}} \right) < \mu < 42 + t_{\text{conf. limit}} \left(\frac{16.27}{\sqrt{15}} \right)$$

At the 55% confidence level the population mean was calculated as:

$$41.5\% < \mu < 42.5\%$$

At the 95% confidence level the population mean was calculated to be:

$$36.4\% < \mu < 47.6\%$$

This indicates that there is a better than 50/50 chance that the mean of the total population of venture capital firms' annual expected returns on investments is $42\% \pm 0.5\%$. Further, this calculation indicates there is a 95% chance that the entire venture capital population expects from 36.4% to 47.6% annual return on its investments if the preceding assumptions hold true.

²² Murray R. Spiegel, Statistics, p. 189.

The second stockholder classification for which attempts have been made to estimate expected gains through stock appreciation are purchasers of over-the-counter stocks and new issue investors. In estimating this factor the following assumptions were made:

1. The growth expectations of this type investor can be reflected in the current market in which he invests.
2. The local OTC stocks and NASDC listed upstate stocks with a high technology basis are representative of the stock market for new high technology ventures. They are in the appropriate risk class.

As evidenced by the research on each of the 25 firms of local interest all but two were found acceptable for this study. Gould Pumps was found to have sales well beyond the previously defined limit and Megadyne closed its doors during the course of the study.

For the 25 firms studied the bid and asked price fluctuations were plotted over a nine month period from January 1, 1972 as shown in Appendix C. As noted earlier, my basic premise is that the investors' stock appreciation expectations on new high technology issues are directly reflected by the recent performance of stocks in similar risk class. If we assume an investor will use only one of three basic strategies:²³

1. Invest to maximize his maximum gain.
2. Invest to maximize his minimum gain.
3. Invest to minimize his maximum loss.

The later two strategies would tend to force an investor toward the large exchange stocks which are much less volatile. The first strategy is felt to be most appropriate for investors in new small high technology firms.

In general, it is assumed that this type of investor concentrates on the largest potential gains possible in the appropriate risk class investment. I have also neglected the trading cost and bid/ask differentials for this analysis taking the most optimistic view of the market in line with perceived investor attitudes. A summary of the stock price fluctuations is shown in the chart on the next page.

SUMMARY OF STOCK PRICE CHANGES FROM DECEMBER 31, 1971 TO OCTOBER 31, 1972

	<u>Average Change</u>	<u>Maximum Increase</u>	<u>Maximum Decrease</u>
AD DATA	0%	+200%	-200%
AQUASONICS	-700%	+300%	-1300%
COMPUTER CONSOLES	- 18%	+ 51%	- 67%
DETECTION SYSTEMS, INC.	- 26%	+ 20%	- 50%
FERRONICS, INC.	- 10%	+100%	-150%
GOULD PUMPS**	0%	+ 35%	- 31%
GRAHM MANUFACTURING	- 30%	+ 38%	- 43%
GRAPHIC SCIENCES	- 33%	+ 35%	- 36%
HAMILTON DIGITAL	- 34%	+ 50%	- 45%
INFODATA SYSTEMS	- 55%	+ 20%	- 61%
KAYEX	- 66%	+160%	- 77%
LASER ENERGY	0%	+100%	- 50%
MARINE RESOURCES	- 66%	+ 87%	- 83%
MEGADYNE*	+600%	+ 600%	- 46%
MESON	+ 40%	+ 90%	- 47%
METRIX	- 78%	+350%	- 90%
PHOTOMETRICS	+ 48%	+100%	- 40%
R. D. PRODUCTS	- 80%	+ 16%	- 80%
ROCHESTER INSTRUMENT SYSTEMS	+ 41%	+100%	- 44%
SCIENTIFIC RADIO, INC.	+ 25%	+ 39%	- 13%
SYKES DATATRONICS	+ 46%	+133%	- 50%
TAPECON, INC.	+ 50%	+120%	- 55%
TEL PAGE	+100%	+100%	- 50%
TRANSMATION	- 50%	+ 25%	- 55%
YONDATA	- 50%	+ 16%	- 50%

** Data not used since firm was found too large for this study.

* Data not used for analysis since firm was out of business by November 1972

As noted in the theory, the cost of equity is defined as:

$$C_E = Kg + \frac{g}{1 - b}$$

Since many firms floated their own new issue and those that paid commissions and had noticable flotation costs showed $b < 10\%$, it will be neglected in light of the large value of $g(101\%)$. If one considers the inside investors' expectations of 41% it is unreasonable to assume $K < 1$. Therefore, at best the results indicate that mean investors' expectations lie between 41% (most conservative) and 101% (most optimistic). Both extreme values will be used sequentially in the composite capital structure.

That is:

$$C_{E_1} = 41\%$$

$$C_{E_2} = 101\%$$

As noted in the theory, the cost of retained earnings will be defined as:

$$C_R = \frac{g(1 - t_p)}{1 - t_g}$$

which for this study can be reduced to:

$$C_R = C_E \left(\frac{1 - t_p}{1 - t_g} \right)$$

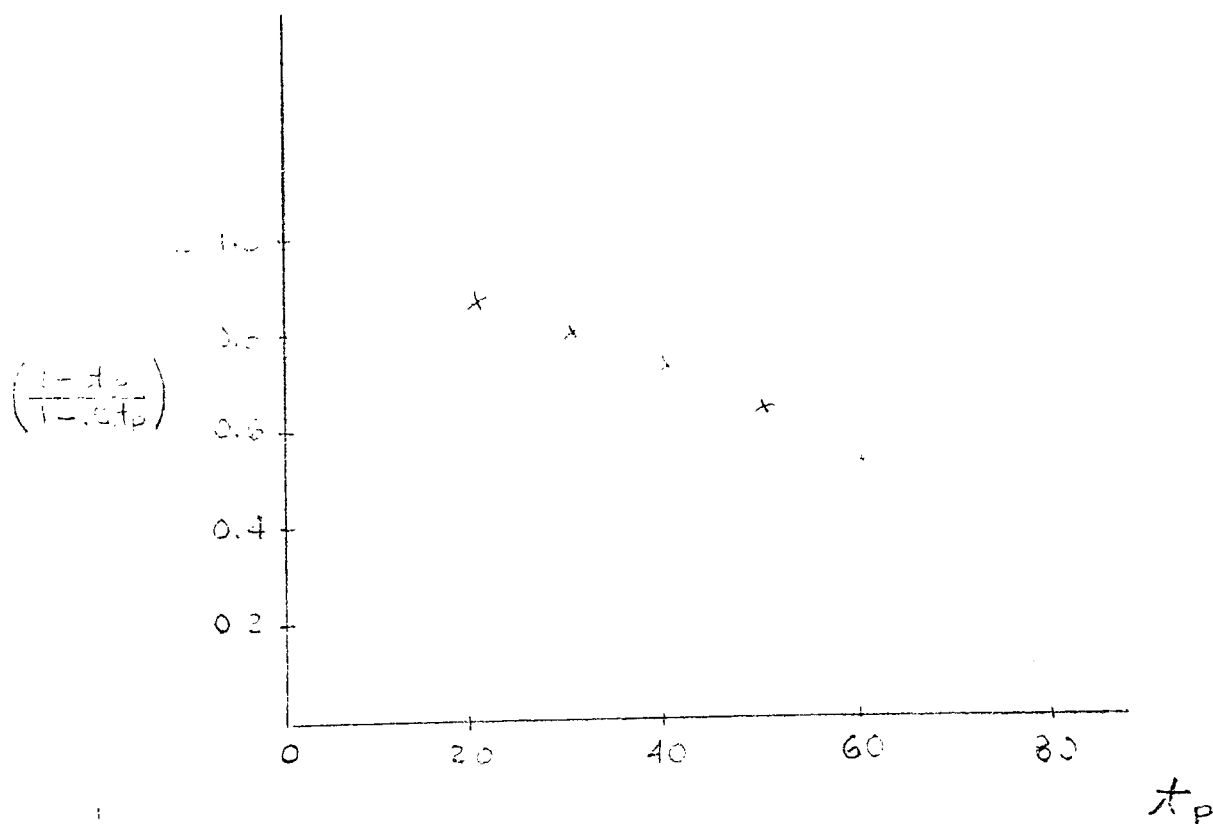
Where: t_p = investors' tax rate on dividends

t_g = investors' capital gains tax

With long term capital gains tax, 1/2 that of ordinary income we can write:

$$\left(\frac{1 - t_p}{1 - t_g} \right) = \left(\frac{1 - t_p}{1 - .5 t_p} \right)$$

When this factor is plotted for practical investor tax rates as shown below it is evident that it is not extremely sensitive to tax rates.



The average value of the factor is 0.75. Therefore one can reasonably assume $C_R = 0.75 C_E$ in the average case. However, the research indicates that few firms had sufficient retained earnings to consider in their capital structure i.e., $W_R \approx 0$. $\therefore C_R W_R = 0$.

III. COST OF DEBT FOR THE SURVEYED FIRMS

As noted in the theory on the cost of debt capital, this cost should be defined as:

$$C_D = D' (1 - t_c)$$

Where: D' is the rate of interest adjusted for acquisition costs

t_c is the corporate tax rate.

Of the 25 firms surveyed, sufficient information for calculating the average interest rate on debt capital was available on 9 firms.

The weighted average value of the interest rate information collected was found to be $8\frac{1}{4}\%$ with a standard deviation of 0.88%. Since the sample size was small (9) the "student" t distribution was again used to relate the results to the assumed normal total population. At the 55% confidence level the actual population mean interest rate could lie between 8.2 and 8.3 percent. At the 95% confidence level the actual population mean interest rate could lie between 7.67% and 8.87%.

This small variation in interest rates is a result of several factors. First, it was likely that most firms dealt with the same banking community in upstate New York. Second, it was found that many loans were SBA backed and therefore had a maximum interest rate fixed by the federal government.

Most of the firms had minimal earnings due to heavy investments into the research and development of new products. Therefore, the minimum tax rate of 22% will be used as it is applicable to annual net earnings under \$20,000. The combination of $8\frac{1}{4}\%$ interest rate and 22% tax rate produces an average cost of debt capital given by:

$$C_D = 8\frac{1}{4} (1 - 0.22) = 6.4\%$$

This cost will be used in the estimate for the cost of debt of the composite firm.

IV. THE COMPOSITE FIRM AND A SAMPLE INVESTMENT OPPORTUNITY

The cost of capital has been defined as:

$$C_T = W_L C_L + W_E C_E + W_R C_R + W_D C_D$$

Where: W is the relative weight of each component in the capital structure.

C is the effective cost of that component.

The research surveyed 25 firms to determine the effective cost of the various components of this capital structure. In summary, this led to the following estimates:

$$C_E = 41\% \text{ to } 101\%$$

$$C_R = 0.75 C_E$$

$$C_D = 6.4\%$$

The relative weight of each of these components was also sampled and is summarized on the following page. The accounts payable portion of the capital structure was found to average 11% of the firms total capital. This, however, was in line with an average payment period of thirty days to take full discounts in all but one case. Since this cost of debt is effectively 0 when the discount is taken, it follows that the (WC) product for this portion of the capital structure is also zero. The "student" t distribution was again used to relate these findings to an assumed normal

SUMMARY OF CAPITAL STRUCTURES

	<u>Accounts Payable</u>	<u>Debt</u>	<u>Stockholders' Equity</u>
Firm #1	33%	20%	43%
Firm #2	15%	25%	49%
Firm #3	---	38%	60%
Firm #4	10%	26%	55%
Firm #5	9%	0	86%
Firm #6	16%	58%	23%
Firm #7	6%	37%	54%
Firm #8	5%	28%	64%
Firm #9	8%	0	92%
Firm #10	10%	62%	21%
Firm #11	5%	46%	40%
Firm #12	11%	57%	26%
Firm #13	4%	0	72%
	<hr/>	<hr/>	<hr/>
Sample Mean	11%	30% (40%)	53%
Sample Std. Dev.	7.5%	23% (14.5%)	22%
55 Conf. Lim.*	± 0.3	± 0.8 (± 0.6)	± 0.8
95 Conf. Lim.*	$\pm 4.2\%$	± 11.8 (± 8.8)	$\pm 11.3\%$
Number of Firms in Statistic	12	13 (10)	13

*"Students" t distribution estimate

It should be obvious from the above summary that not all components of the capital structure are included. The sum of the three components will therefore be less than 100%.

population. At the 55% confidence level, the population mean would lie at $11\% \pm 0.3\%$ and at the 95% confidence level $11\% \pm 4.2\%$. This variation is still within practical limits for assuming that most firms sampled are taking full discounts on their accounts payable.

Debt was found to average thirty percent of the capital structure in the firms analyzed. It was found to average forty percent in those firms having debt in their capital structure, as shown in parenthesis. The lack of significant amounts of debt in the capital structure is not too unusual when one considers that several of the firms analyzed are new and have little or no revenue on sales. The worse case analysis I will use for the composite corporation consists of a minimum amount of debt since its effective cost is much less than the cost of stockholders' equity. Further, it is realistically in line with the high risk firms analyzed to have a minimum amount of debt. The variability in the estimate of the population mean was found to be $\pm 0.8\%$ and $\pm 11.8\%$ for the 55% and 95% confidence levels respectively. This wide variability in this estimate is mainly a result of the lack of debt in 23% of the samples. Furthermore, two firms leased their products and therefore were heavily debt financed. The percentage of debt in the capital structure will be taken at $W_D = 30\%$ for the composite firm in light of the above analysis.

The percentage of stockholders' equity in the capital structure of the firms analyzed was found to be 53% with a standard deviation of $\pm 22\%$. This large variability in the data is directly a result of the lack of debt in several firms with excessive debt in others as noted above. Using

the "students" t distribution, the uncertainty in estimating the population mean was determined. At the 55% confidence level the population mean (assumed normal distribution) could be said to lie between 52.2% and 53.3% and at the 95% confidence level between 41.7% and 64.3%. This estimate is considered representative of the population in the appropriate risk class and therefore 53% is used as the percent equity in the composite firm ($\bar{w}_E = 53\%$).

In summary, the composite firm could be described as:

Cost of Equity	C_E	=	41% to 101%
Percent of Equity	W_E	=	53%
Cost of Retained Earnings	C_R	=	$0.75 C_E$
Percent of Retained Earnings	W_R	=	0
Cost of Debt	C_D	=	6.4%
Percent of Debt	W_D	=	30%
Cost of Accounts Payable	C_L	=	0
Percent of Accounts Payable	W_L	=	11%

When applied to our original equation this yields:

$$\begin{aligned}
 C_T &= W_L C_L + W_E C_E + W_R C_R + W_D C_D \\
 &= (0)(11) + (.53)(41 \text{ to } 101) + (0)(0) + (.30)(6.4) \\
 C_T &= (21 \text{ to } 53.5) + 1.9 \\
 C_T &\approx 23 \text{ to } 56\%
 \end{aligned}$$

For the composite firm I will use $W_D C_D = 1.9\%$ and $W_E C_E = 21 \text{ to } 53.5\%$

V. A SAMPLE INVESTMENT OPPORTUNITY

I have assimilated a sample investment opportunity from my personal experience to assist in illustrating how the cost of capital and capital budgeting model may be used. This sample is summarized on the next page in the format outlined in Chapter II. Each variable is based on marketing product information obtained from a small firm appropriate for the study. The probability of occurrence of each event was subjectively assigned based on the experience of several marketing and engineering personnel. There are many techniques which may be used to develop subjective estimates of the type used in the sample. It is not the purpose of this paper to limit the models applicability by limiting it to one technique for assigning subjective probabilities to the input variables. The technique used may be suboptimal and its optimization should be the subject of another study.

SAMPLE INVESTMENT OPPORTUNITY

	Minimum		Average		Maximum	
	Qty	Likelihood	Qty	Likelihood	Qty	Likelihood
Annual Sales Less Variable Costs Plus Estimated Taxes	25K	0.1	100K	0.7	350K	0.2
Fixed Annual Operating Costs	20K	0.2	50K	0.6	100K	0.2
Residual Value of Investment	1	0.3	10K	0.4	20K	0.3
Useful Life of Investment	2	0.1	5	0.8	10	0.1
Initial Investment	40K	0.2	100K	0.75	150K	0.05

NOTE: K = 1000 multiplier

CHAPTER V

COMPUTER PROGRAM TO GENERATE

IRR VERSUS RISK CURVE

The computer program outlined in the flow chart on the following page, (Figure #5) takes data related to the proposed new venture and provides data to plot a histogram of the probability of occurrence of various internal rates of return on a new venture.

The program starts by reading the following variables:

A(J) = Annual sales less variable costs and estimated taxes

B(J) = Fixed annual operating costs

C(J) = Residual value of investment

D(J) = Useful life of investment

E(J) = Cost of initial investment

V(J) = Probability of A(J) occurring

W(J) = Probability of B(J) occurring

X(J) = Probability of C(J) occurring

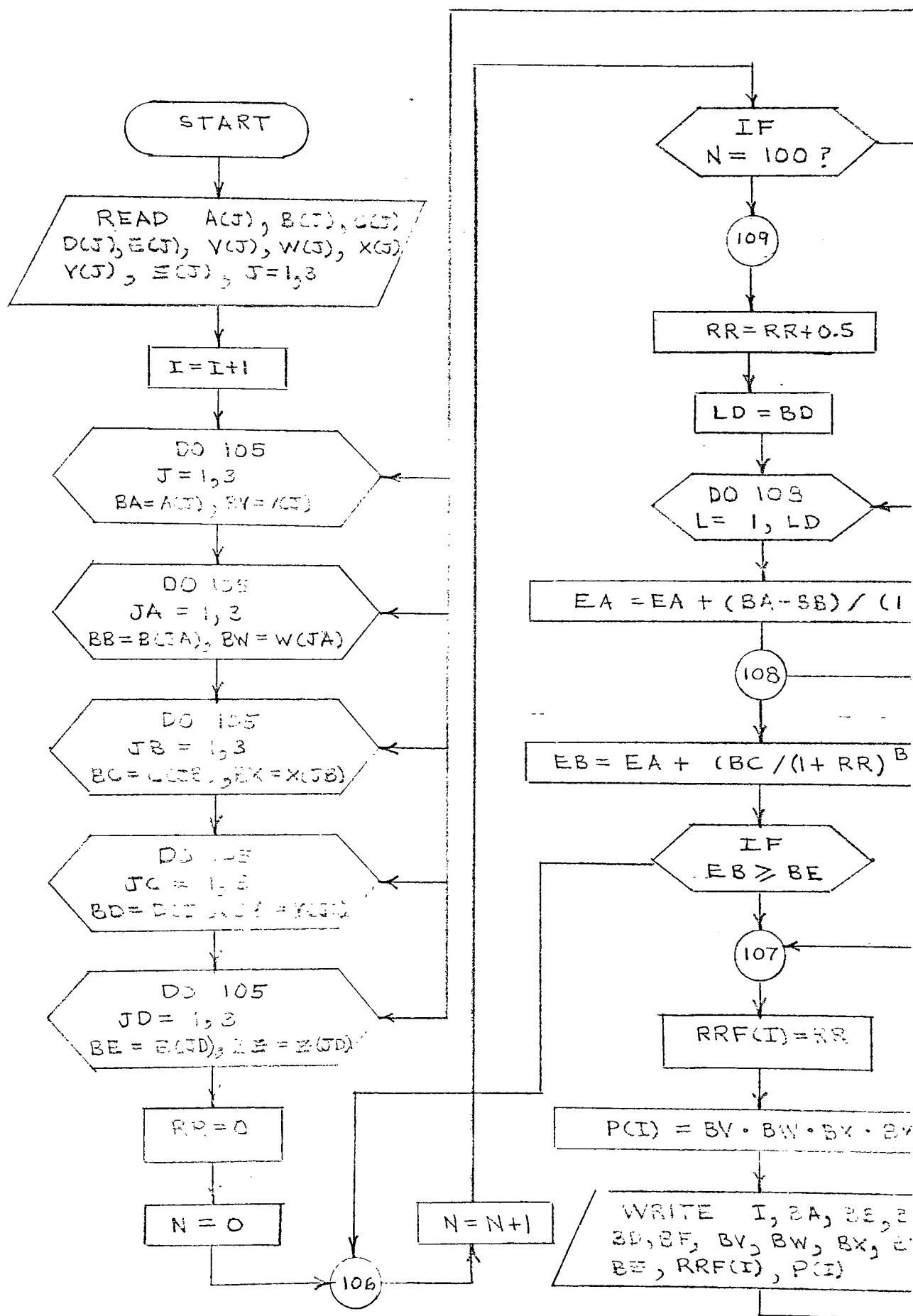
Y(J) = Probability of D(J) occurring

Z(J) = Probability of E(J) occurring

Where J = 1, 2, 3 minimum, average, maximum value of each variable

Through DO Loops nested five deep all possible combinations of the five variables are selected along with their associated probabilities of occurrence. The value of S is set equal to 1 initially and incremented by 1 with each calculation to keep track of the 2^4 results. The rate of return RR is initially set to zero and subsequently incremented in steps of $1/2\%$. The value of LD is incremented from 1 to the useful life of investment (BD) and through the associated DO loops, the present value of each year's revenue is calculated. The residual value of the investment is then brought forward to its present value and added to the present value of each year's revenue. This process is repeated in $1/2\%$ increments until the calculated present value of revenue is greater than or equal to the cost of the initial investment. The rate of return at this point is stored as RRF(I).

The probability of FFR(I) occurring is then calculated and stored as P(I). All variables selected for the Ith iteration are then printed out along with P(I) and RRF(I), I is incremented by one and a new set of variables are selected. After all 2^4 possible values of RRF(I) are calculated with their associated P(I) the program could group the data into appropriate ranges. I then could total the probability of an occurrence as PX(PRR) whose abscissa ranges are less than each PRR to arrive at data for plotting the cumulative probability distribution of returns.



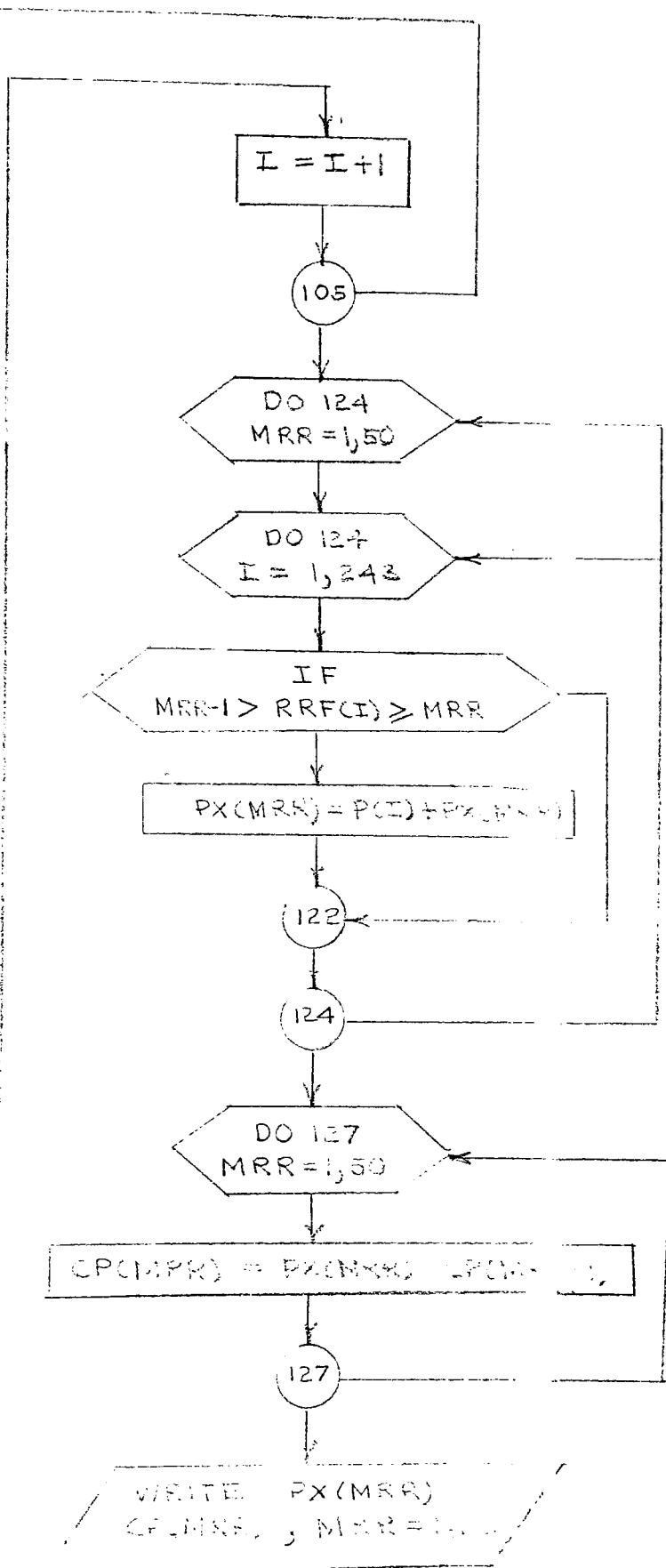


FIG.5

PROGRAM TO
GENERATE
INR VS RISK
CURVE 12-17-72

CHAPTER VI

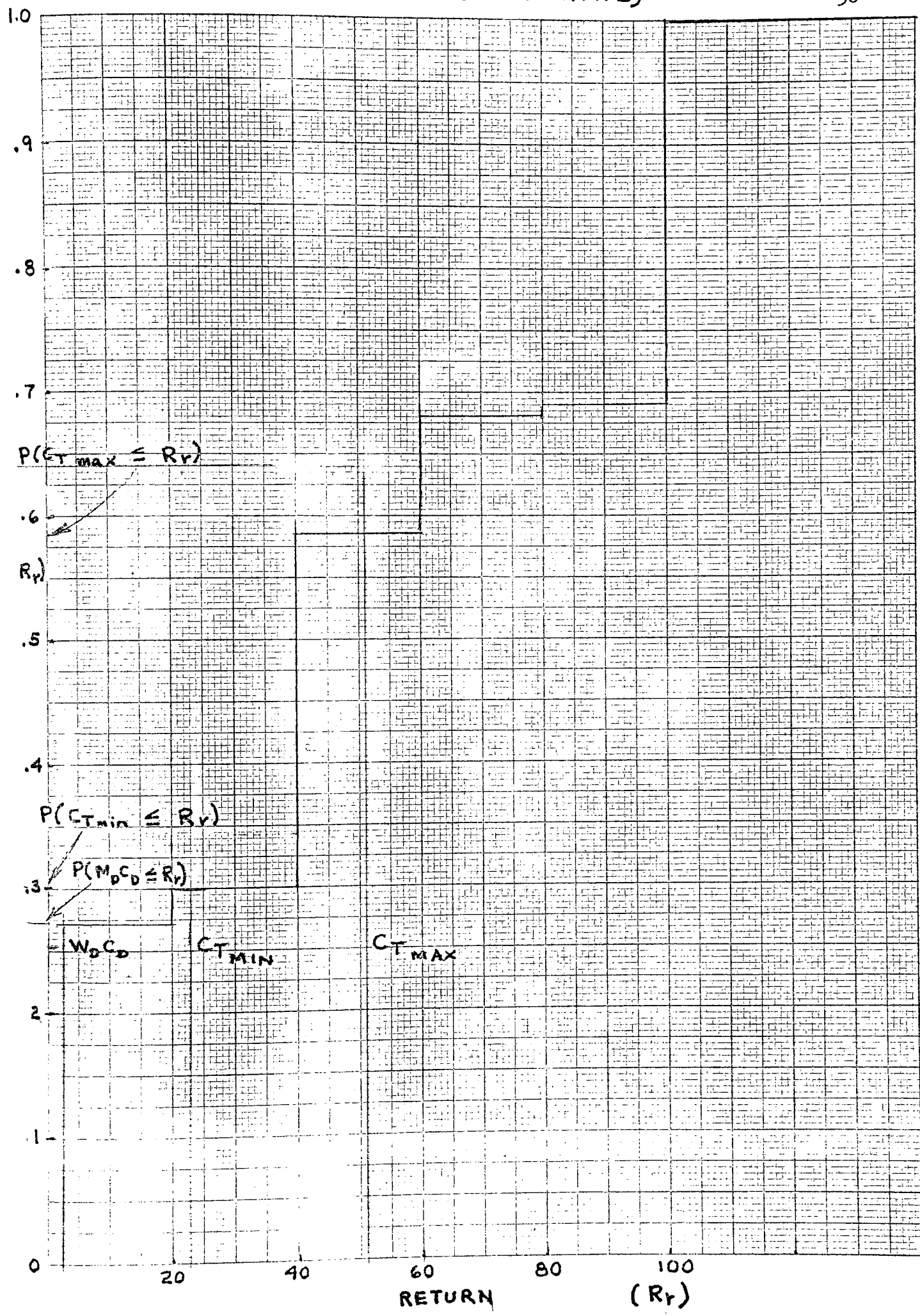
SUMMARY OF RESULTS AND CONCLUSIONS

The aforementioned computer program was used with the sample investment opportunity to define its risk and return characteristics. These results were then compared to the cost of capital components.

I. SUMMARY OF RESULTS

The computer program internal rate of return and risk data was plotted as a probability distribution histogram in Figure #6 on the next page. This curve indicates that there is a 25.5% chance that the internal rate of return will be less than 0.5%, a 29.5% chance it will be between 40 and 60% and a 31% chance it will be greater than 100%. The data was grouped in 20% internal rate of return ranges due to the wide range of possible returns obtained. This wider range of grouping the data also reduces the likelihood of assuming excessive precision in the estimating process.

The cumulative probability distribution of returns is shown in Figure #7. The curve shows the probability that the abscissa value of return will not be achieved. It also permits easy analysis of the sensitivity of the venture to varying amounts of the component costs of capital. The weighted cost of debt and total weighted average cost of capital data derived from the research are plotted as straight lines from their abscissa values.



The utility of this approach to optimizing capital structure can now be readily demonstrated. The weighted cost of debt whose typical value for the new small firm was found to be 1.9% is shown graphically as the vertical line nearest the origin of Figure #6. In line with this proposed approach, if one decreased the amount of debt financing used for this venture to near zero, the likelihood of defaulting on payment would be 25.5%. For the typical small firm in this risk class, the likelihood of defaulting on its debt would be 27.2%. However, of more significance is the apparent result that an increase in the amount of debt by a factor of two to 60% of the total capital would produce an insignificant increase in the likelihood of default. It would also significantly reduce C_T and therefore significantly reduce the likelihood of stockholder dissatisfaction.

The two plotted total cost of capital lines reflect the variability in expected equity costs obtained from the research. If one chooses the minimum return to investors $C_{T_{\min}}$ as appropriate, the probability of the firm's success in the eyes of the investors is 70%. If one chooses the maximum return to investors $C_{T_{\max}}$ the probability of the firm's success in the eyes of the investors is reduced to 41.5%. However, the insensitivity of the returns to varying amounts of debt showed that a factor of two increase in debt should not increase significantly the risk of default on debt. Furthermore, this increase in debt would permit reductions in the higher costing equity components of capital and reduce the overall costs of capital. For example, the increase in debt proposed earlier would increase the probability of the firm's success in the eyes of the stockholders to 70% from 41.5%. This is because $C_{T_{\max}}$ would be reduced to 28% due to a 57% change in the weight of equity.

The above example demonstrates the utility of this approach. However, it is recognized that any application of this technique must also take into consideration the attitude of the debt sources and the difficulty associated with reducing equity holdings in a successful firm of this type.

II. CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

I have concluded that the proposed technique for evaluating capital investment alternatives and optimally adjusting the capital structure of new small firms has demonstrable utility. It permits effective visual correlation of a proposed new ventures risk with the way it is financed. This correlation permits variations in the new firms capital structure to achieve minimum risk and cost of capital.

Further research should be performed to accurately describe an effective technique to subjectively assign probabilities to the component characteristics of a proposed new venture. Furthermore, correlation coefficients could be developed for each component of the new venture decision matrix which would permit a more accurate estimate of the total new venture probability characteristics. It is also felt that techniques for rapidly modifying the capital structure could be developed within obvious practical limitations.

Recognizing that this additional work is essential does not negate the utility of the proposed analytical tool. This is more evident when one compares it to the oversimplified techniques now currently employed to analyze new ventures. This technique should immediately provide a useful adjunct to the current analytical techniques and provide a more sensitive financial guide to new venture investors and entrepreneurs.

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Printing Office, 1967.
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APPENDIX A

A SAMPLE OF THE LETTER WHICH WAS SENT TO THE RESEARCHED FIRMS

41 Penn Lane
Rochester, New York 14625
October 18, 1972

Financial Officer
TEL-PAGE CORPORATION
401 Sherman Street
Rochester, New York

Dear Sir:

I am reviewing the characteristics of Rochester area small businesses as part of my graduate studies at RIT. I have selected your firm for analysis in this thesis. I would appreciate a copy of your most recent prospectus and your latest financial summary to aid in this study.

Yours truly,

A handwritten signature in cursive script, appearing to read "B. R. Robinson".

B. R. Robinson

APPENDIX B

A DESCRIPTION OF RESEARCHED FIRMS

AD DATA SYSTEMS
830 Linden Avenue
Rochester, New York

AD DATA SYSTEMS is a nine year old electronics firm specializing in conversion of information into a form readable by computers. It employs 125 people with net 1971 sales of \$861,133, earnings of (\$129,208) on assets totaling \$1,230,310. Its performance in sales and earnings over the last five years has been cyclic with a generally upward trend.

August 27, 1971 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	6%	36% (assumed)
Debt	37%	8.01%
Stockholders' Equity	54%	

Of the 54% capital representing shareholders' equity it was found that the total stockholders' investment in the firm has been diluted through losses by 36%. Forty-eight percent of the stockholders' equity was obtained in the public offering of 1968 and represents only 7.4% of the outstanding shares of stock.

Sources of Information:

1. AD DATA SYSTEMS, INC., Prospectus dated May 10, 1968.
2. AD DATA SYSTEMS, INC., 1971 Annual Report

AQUASONICS, INC.

Aquasonics was started in Rochester and was reported on January 18 - 20, 1972 to be in production of an all-terrain vehicle. It was reported the firm raised an urgently needed 1/2 million and that it was originally formed to make a jet propelled boat. It had difficulties trying to make bus shelters and the stock was trading in the 1/4 to 3/4 range. No further information was made available.

Source of Information:

Upstate Business Journal, January 18-20, 1972, p. 1.

COMPUTER CONSOLES, INC.
1257 University Avenue
Rochester, New York

Computer Consoles is a four year old firm which sells DATA MANAGEMENT SYSTEMS. It had 1971 sales of \$1,578,683, a net loss of \$879,249 and has assets totaling \$2,635,332. Its sales have increased steadily over the last four years; however, losses have been sustained consistently.

December 31, 1971 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	15.4%	
Debt	25.4%	9 $\frac{1}{4}$ %
Stockholders' Equity	49%	

The 49% stockholders' equity represents only 30% of the total investment by stockholders. Furthermore, 53% of the total investment by stockholders was in the form of 8% cumulative preferred stock.

Sources of Information:

1. Computer Consoles, Inc., 1971 Annual Report
2. Computer Consoles, Inc., Applications Reports, 2050, 2051, and 2052.
3. Computer Consoles, Inc., Interim Reports, June 30, 1972, and April 1, 1972.

DETECTION SYSTEMS, INC.
400 Mason Road
Fairport, New York 14450

DETECTION SYSTEMS is a four year old firm engaged in the design, manufacture and installation of electronic intrusion alarm systems. It has 1972 total revenue of \$818,091 with a net loss of \$260,490 based on the 1972 annual report. However, the July 31, 1972 quarterly report indicates earnings of \$3,990 on sales of \$293,125. The firm's total assets as of March 31, 1972 were \$424,020.

March 31, 1972 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	33.7%	
Debt	20%	9 $\frac{1}{2}$ %
Stockholders' Equity	42.7%	

The 42.7% stockholders' equity represents only 13.5% of the total investment by stockholders. A public offering with 7.7% potential discount resulted in an equity contribution of 60% of total stockholder investment with only 21.3% control.

Sources of Information:

1. DETECTION SYSTEMS, INC. 1972 Annual Report.
2. Three Month Report, June 30, 1972, of DETECTION SYSTEMS, INC.
3. DETECTION SYSTEMS, INC., May 15, 1969 Prospectus.

FERRONICS, INC.
66 North Main Street
Fairport, New York 14450

Ferronics was incorporated in 1968 to engage in manufacturing and marketing ceramic magnetic materials used primarily in the electronics and the computer industry. Its current annual rate of sales is \$640,000 with a net quarterly income \$1,511 for the July - September 1972 quarter. Total assets as of September 30, 1972 were \$666,920.

September 30, 1972 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	5.25%	
Debt	27.8%	7.24%
Stockholders' Equity	63.8%	

The 63.8% stockholders' equity represents 51% of the total investment by stockholders. A July 10, 1970 offering of 7.4% of the outstanding stock (12.6% underwriting discount) produced 65% of the total stockholders' investment.

Sources of Information:

1. FERRONICS, INC. consolidated Balance Sheet and Income Statement September 30, 1972.
2. FERRONICS, INC., July 10, 1970 Prospectus.
3. FERRONICS, INC., 1970, 1971 Annual Reports.

GOULD PUMPS
Seneca Falls, New York

Gould Pumps are designed and manufactured for use by household consumers, marine equipment, anti-polluation equipment, and nuclear power plants. It had 1971 (end of third quarter) earnings of \$2,492,925 on sales of \$39,292,680. Based on my previous criteria for a small business, this firm will not be considered further in this analysis and will be used for background only.

Sources of Information:

Upstate Business Journal, February 1-3, 1972, p. 1.

GRAHM MANUFACTURING COMPANY, INC.
Batavia, New York 14020

"Graham manufacturers heat exchanges, condensers, steam jet ejectors, fume scrubbers, relief valves, and related equipment for the petroleum, petro-chemical, chemical and other process industries." (From first source of information below). It had 1971 net income of \$524,000 on sales of \$11,224,000. It has shown growth in earnings of 42% in the last two years. The firm has assets as of December 31, 1971 of \$7,815,000.

CAPITAL STRUCTURE:

Debt	38%
Stockholders' Equity	60%

Source of Information:

1. Upstate Business Journal, July 11, 1968, p. 18.

GRAPHIC SCIENCES
Danbury, Connecticut

Graphic Sciences originated in Rochester, New York to make telephone transceivers in competition with Xerox. It had 1972 earnings of \$658,659 on revenues of 9.8 million. It manufactures devices for transmitting copies by telephone. No detailed financial information was obtainable.

Sources of Information:

1. Upstate Business Journal: September 5, 1972, p. 1.
July 27, 1972, p. 4.
February 8, 1972, p. 6.

HAMILTON DIGITAL CONTROLS, INC.
Utica, New York

Hamilton Digital Controls was a pioneer in high performance shieldless magnetic recording heads and now sells a shieldless head for cassette recorders and a low wear version of the same item. It has recently introduced a vocal recorder which translates computer output into words. As of August 8, 1972 it had latest fiscal year income of \$217,800 on sales of \$1,082,000. It had a current sales backlog of 1 million and will be expanded into a facility twice as large as it occupied as of August 8, 1972. No further financial details were available.

Source of Information:

Upstate Business Journal, August 8, 1972, p. 8.

INFODATA SYSTEMS, INC.
Rochester, New York

Infodata Systems provides computer services and information management systems to industry and government. It has received patents on its Inquire information management system and has at least one contract which could be worth \$500,000 over a three year period. It also sells a comprehensive time scheduling, accounting, and management reporting computer management system to radio and television broadcasting stations. No further information was available on this firm.

Sources of Information:

Upstate Business Journal: July 18, 1972, p. 1
September 5, 1972, p. 8.

KAYEX CORPORATION
1000 Milstead
Rochester, New York

Kayex is a local manufacture of electronic semi-conductor devices. It also has a subsidiary which does special colar imaging and whose sales represent about 1/4 of gross sales. Its 1971 fiscal year sales were 1.1 million down 4.8% from 2.1 million the previous year. This resulted in a net loss of \$931,000 versus \$216,654 a year earlier. It reported gross sales for the first half of this year dropped to \$575,845 from \$642,665. This firm openly refused to send me copies of its latest financial report for obvious reasons.

Sources of Information:

Upstate Business Journal: August 22, 1972, p. 9.
July 30, 1972, p. 7.
April 18, 1972, p. 7.
March 21, 1972, p. 8.

LASER ENERGY, INC.
320 North Washington
East Rochester, New York

LASER ENERGY was incorporated January 2, 1969 and was to manufacture and market a low-priced laser and process optical thin film coatings. It financed its initial operations with \$275,000 from inside investors (700,000 shares @ 1¢/share, 250,000 shares @ \$1/share) and raised an additional \$491,574 (200,000 shares @ \$3/share), through a public offering in October 1969. The firm showed a net loss of \$105,526 on sales of \$154,521 in 1971 and had assets totaling \$499,965 as of September 30, 1971.

September 30, 1971 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	8%	
Debt	0%	
Stockholders' Equity	92%	

The October 28, 1969 offering was underwritten at a cost of 15% with \$2.60/share proceeds to the company.

Sources of Information:

1. LASER ENERGY, INC., Prospectus, Dated October 28, 1969.
2. LASER ENERGY, INC., 1971 Annual Report.

MARINE RESOURCES, INC.
1268 Atlantic Avenue
Rochester, New York

Marine Resources was established in 1968 to develop high technology products for underwater exploration and investigation. According to F. Robert Hill, the firm has consolidated its local operations with its Submersible Products Division in Florida. Accordingly, he did not care to disclose their most recent financial data.

Sources of Information:

Letter from F. Robert Hill, President; dated April 4, 1973.

MEGADYNE INDUSTRIES, INC.
Rochester, New York

Megadyne Industries was a manufacturer of microelectronics started by two scientists from General Dynamics in 1965. It sold 350,000 shares at \$2/share in the 60's and never saw a profitable year of operation. Controlling interest was purchased in 1970 with the resignation of one founding scientist with 200,000 shares purchased for \$1/share. The firm closed its doors in November reportedly due to financial troubles. No specific financial information was available.

Source of Information:

Upstate Business Journal: November 28, 1972, p. 1.

MESON ELECTRONICS COMPANY, INC.
380 Cottage Street
Rochester, New York

Meson makes solid state timing devices and does a large amount of subcontract electronics work. It had six months' sales as of December 31, 1972 of \$436,828 with earnings of \$24,500. This compares to a \$13,275 loss a year earlier. It introduced a new electronic ignition system on August 1, 1972 which is projected to significantly increase future sales. No further financial information was available at this time.

Sources of Information:

Upstate Business Journal: August 11, 1972, p. 17.
March 13, 1972, p. 1.
February 15, 1972, p. 1 and 3.

METRIX DATA SYSTEMS, INC.
1166 Brooks Avenue
Rochester, New York

Metrix manufactures and sells badge identification systems, data acquisition systems, and a water use recorder. The water use recorder eliminates meter routemen and its use is now being tested by the Monroe County Water Authority. It has deferred much of its preoperational and promotional expenses and showed a net loss of \$80,634 for the 1971 fiscal year. It sold 75,000 shares of stock in 1971 for \$6.50 per share. No further information was available as this firm is still in a start-up situation.

Source of Information:

Upstate Business Journal, August 18, 1972, p. 4.

PHOTOMETRIC DATA SYSTEMS CORPORATION
Holt Road
Rochester, New York

Photometric Data Systems manufactures automatic film transports, a new type of photographic playback system, and a new ultra high speed microdensitometer. It had 1972 net loss of \$126,201 on sales of \$523,752 and had assets totaling \$819,006.

June 30, 1972 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	9.6%	
Debt	62%	7.7%
Stockholders' Equity	21%	

Of the 21% stockholders' equity, it represents only 40% of the total stockholders' investment.

Sources of Information:

1. Photometric Data Systems Corporation 1972 Annual Report.
2. Photometric Data Systems Corporation, 1972 Presidents News Report.

R. D. PRODUCTS, INC.
Victor, New York

R. D. Products' principle business is the design, development and distribution of photo-identification systems to banks, retail stores, commercial credit card companies, schools, industry, and government agencies. It showed a net loss of \$72,290. (Prior to extraordinary items) on sales of \$372,775 for the 6 months ending January 31, 1972. The firm had assets of \$881,669 as of January 31, 1972.

January 31, 1972 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	5.1%	
Debt	45.6%	7%
Stockholders' Equity	40%	

The 40% stockholders' equity represents only 21% of the total investment by stockholders.

Source of Information:

R. D. Products, Inc., May 25, 1972 Notice of Annual Meeting
of shareholders.

ROCHESTER INSTRUMENT SYSTEMS, INC.
 275 North Union Street
 Rochester, New York 14605

Rochester Instrument Systems manufactures and services sophisticated electronic instruments primarily for use by the electric utility and process control industry. It had 1971 net income of \$260,341 on sales of \$5,771,261.

It had assets totaling \$4,580,592 as of October 1, 1971 with a clear strong record of growth over the last ten years.

October 1, 1971 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	10.3%	
Debt	25.8%	7.7%
Stockholders' Equity	55%	

The 55% stockholders' equity represents 100% of the total stockholders' investment. A 1971 offering (10% discount) of 192,872 shares was fully subscribed resulting in an equity contribution of 62% of total stockholder investment with only 27% control.

Sources of Information:

1. Rochester Instrument Systems, Inc., September 7, 1971 Prospectus.
2. Rochester Instrument Systems, 1971 Annual Report.
3. Rochester Instrument Systems, June 30, 1972, March 30, 1972, Quarterly Reports.

SCIENTIFIC RADIO SYSTEMS
401 Lyell Avenue
Rochester, New York 14606

Scientific Radio Systems' major product line is high frequency single sideband communications equipment used as a substitute for phone communications in underdeveloped countries and by government agencies. Its current annual rate of sales is \$1,480,000 and has just completed its first profitable period of operation. The firm had total assets of \$481,198 as of June 30, 1971.

June 30, 1971 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	9.1%	36% (assumed)
Debt	0%	
Stockholders' Equity	86%	

The 86% stockholders' equity represents only 47.5% of the total stockholders' investment. A January 27, 1970 public offering (10% discount) of 100,000 shares at \$8.50 per share resulted in an equity contribution of 80% of total stockholder investment with only 23% control. This offering was self-underwritten and quickly fully subscribed.

Sources of Information:

1. SCIENTIFIC RADIO SYSTEMS, INC., January 27, 1972 Prospectus.
2. Long Island Investor, June 30, 1971, Volume 3 - Number 5.
3. SCIENTIFIC RADIO SYSTEMS, INC., June 30, 1971 Annual Report.
4. Personal interview with David Hoffman, Vice President, Treasurer, and Director.

SYKES DATATRONICS, INC.
 375 Orchard Street
 Rochester, New York 14606

Sykes Datatronics' product line is primarily for the minicomputer market using cassette transport products and data communications' products. Its 1972 sales were \$1,636,000 with net income of \$46,000. Total assets as of February 29, 1972 were \$1,856,268.

February 29, 1972 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	16%	36% (assumed)
Debt	58%	9.1%
Stockholders' Equity	23%	

Sources of Information:

1. Sykes, 1972 Annual Report
2. Sykes, August 31, 1972 Six Month Report

TAPECON, INC.
475 River Street
Rochester, New York

Tapecon is a specialty converter of electrical and industrial tapes and metal foils. It has reported earnings of \$29,987 for the calendar year 1972 against losses of \$12,907 for the prior year's comparable period. The shipments during the first half year were \$955,207 with a \$233,608 backlog. No further financial information was available on Tapecon at this time.

Sources of Information:

Upstate Business Journal: August 15, 1972, p. 1.
May 2, 1972, p. 7.
May 9, 1972, p. 10.

TEL-PAGE CORPORATION
401 Sherman Street
Rochester, New York

Tel-Page is engaged in the sale and rental of mobile telephone and radio paging services. The firm showed a net income for the year ended December 31, 1971 of \$13,712 on sales of \$531,351. It had assets of \$810,366 as of December 31, 1971.

December 31, 1972 CAPITAL STRUCTURE:

	<u>% of Total Capital</u>	<u>Effective Cost/year</u>
Accounts Payable	10.8%	
Debt	57%	8.9%
Stockholders' Equity	25.6%	

It should be noted that 81% of debt is installment loans on equipment with interest rate assumed to be 10%. Further, it was evident that the 25.6% stockholders' equity represents only 58% of the total stockholders' investment.

Sources of Information:

1. Tel-Page Corporation 1971 Annual Report.
2. Tel-Page Corporation July 5, 1972 Proxy Statement.

TRANSMATION, INC.
Rochester, New York

Transmation is a local electronics firm which has also operated a small plastics subsidiary. The Product Packaging Corporation plastics subsidiary was reported to have orders in excess of \$200,000 in February 1972 but was sold in September 1972 for \$50,000. Transmation recorded a loss on the subsidiary sale of \$111,000 of which \$62,000 was included in its losses of the first fiscal quarter of 1972. No further financial information was available on Transmation, Inc.

Sources of Information:

Upstate Business Journal: February 22-24, 1972, p. 9.
September 12, 1972, p. 7.

YONDATA CORPORATION
40 St. Paul Boulevard
Rochester, New York

Yondata is principally engaged in the design, assembly and implementation of special purpose computer systems along with operating a time-shared computer facility.

April 30, 1972 CAPITAL STRUCTURE:

	<u>% of Total Structure</u>
Accounts Payable	4.1%
Debt	0%
Stockholders' Equity	72%

Lease agreements have been reflected in the balance sheet at 21.3% of the total liabilities. The 72% stockholders' equity represents only 54% of the initial stockholders' investment. The firm publicly issued 34.4% of its outstanding stock @ \$1/share June 3, 1969. It was self underwritten with no commissions or discounts offered.

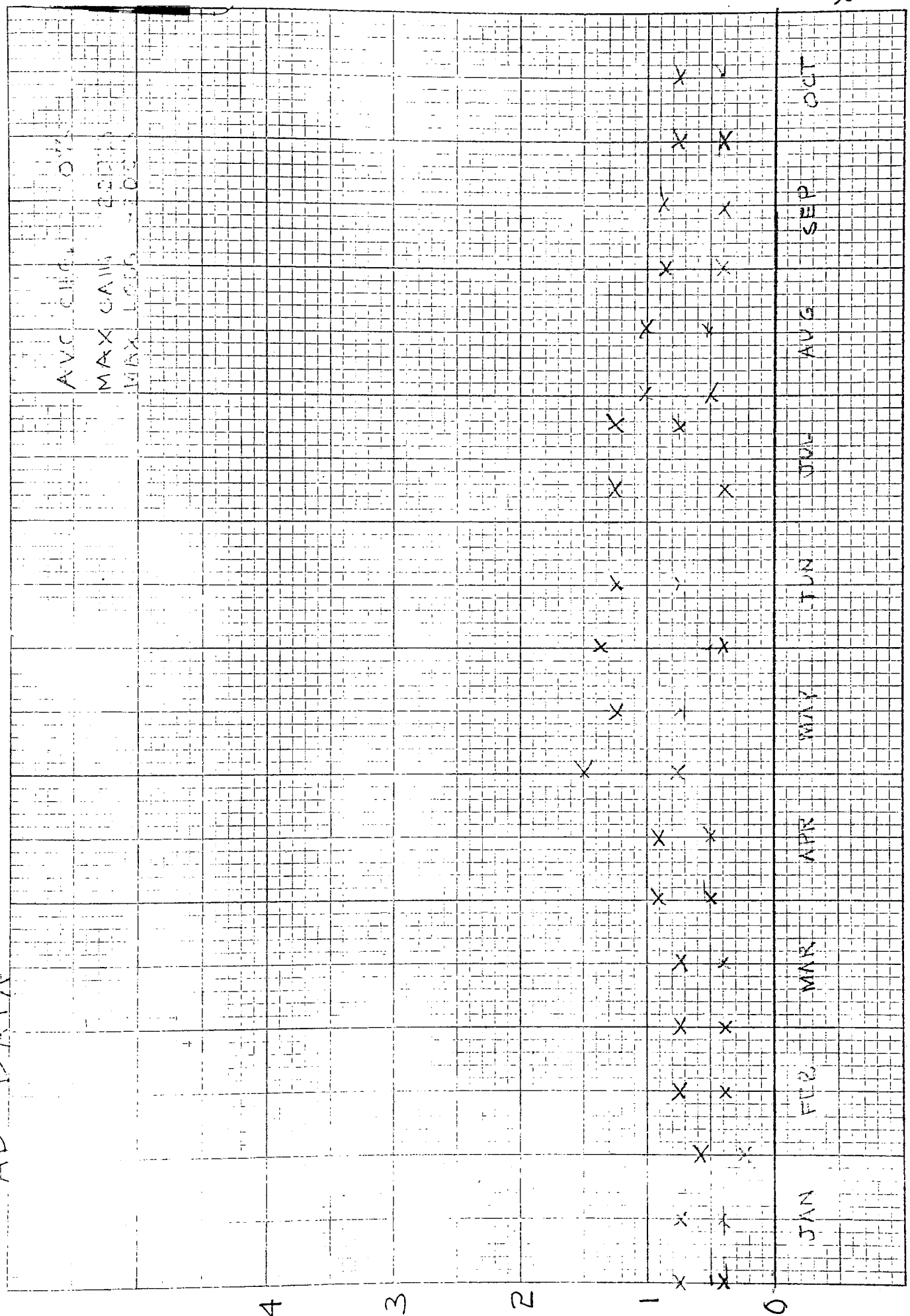
Sources of Information:

1. Yondata Corporation, August 22, 1972 Annual Report.
2. Yondata Corporation, June 3, 1969 Prospectus.

APPENDIX C
STOCK PRICE CURVES

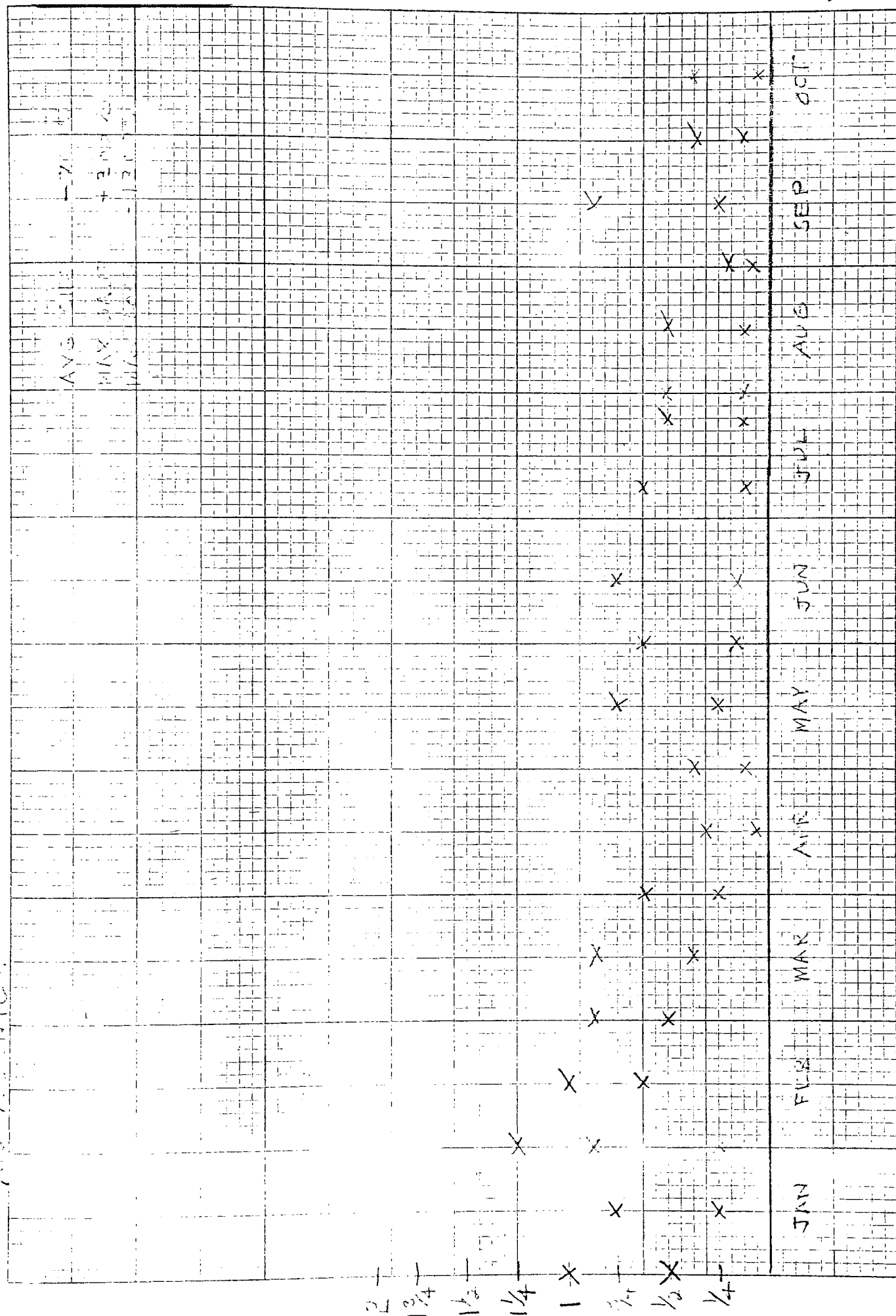
The stock price fluctuation were plotted for a nine month period as listed in selected issues of Upstate Business Journal.

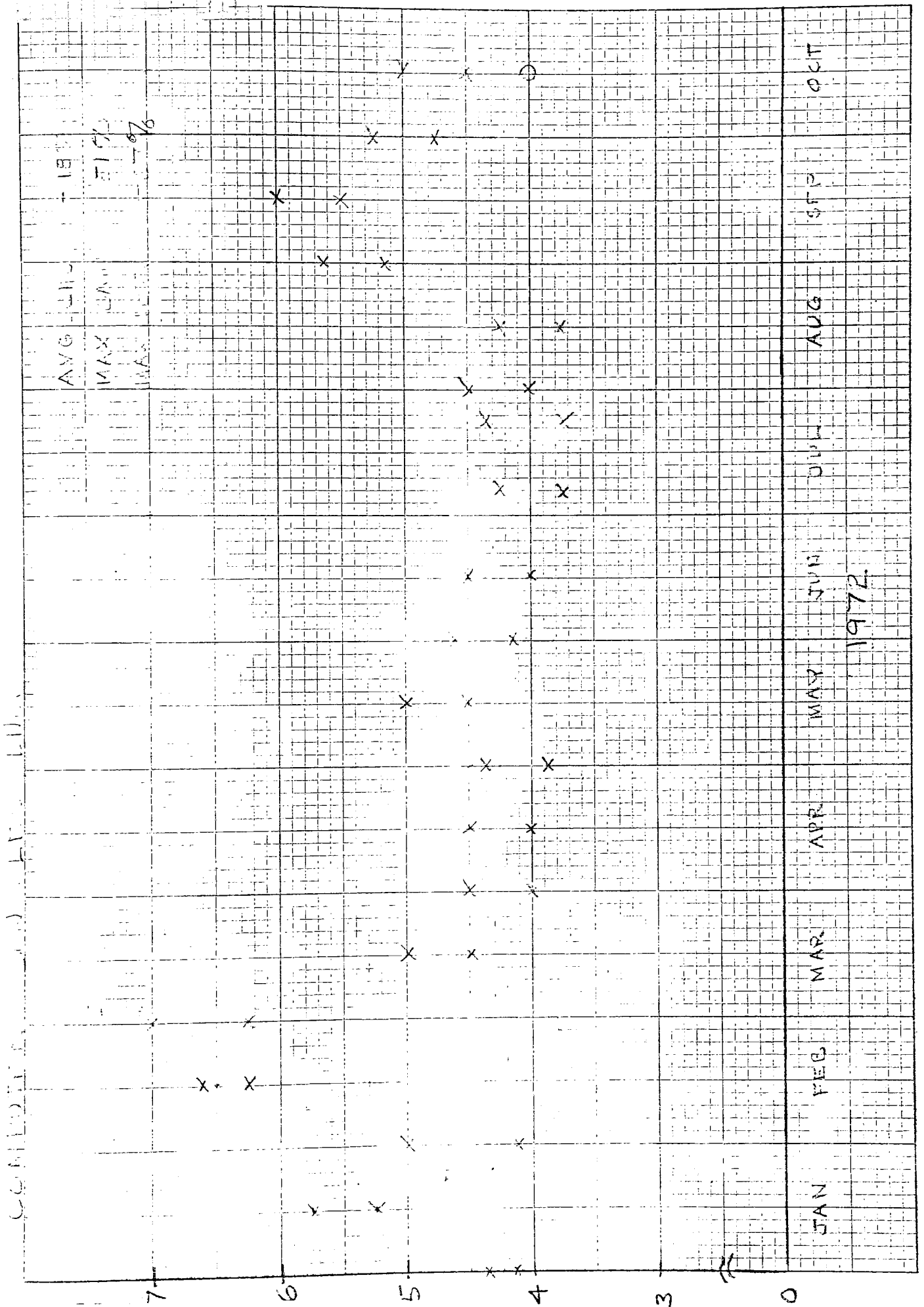
AD DATA



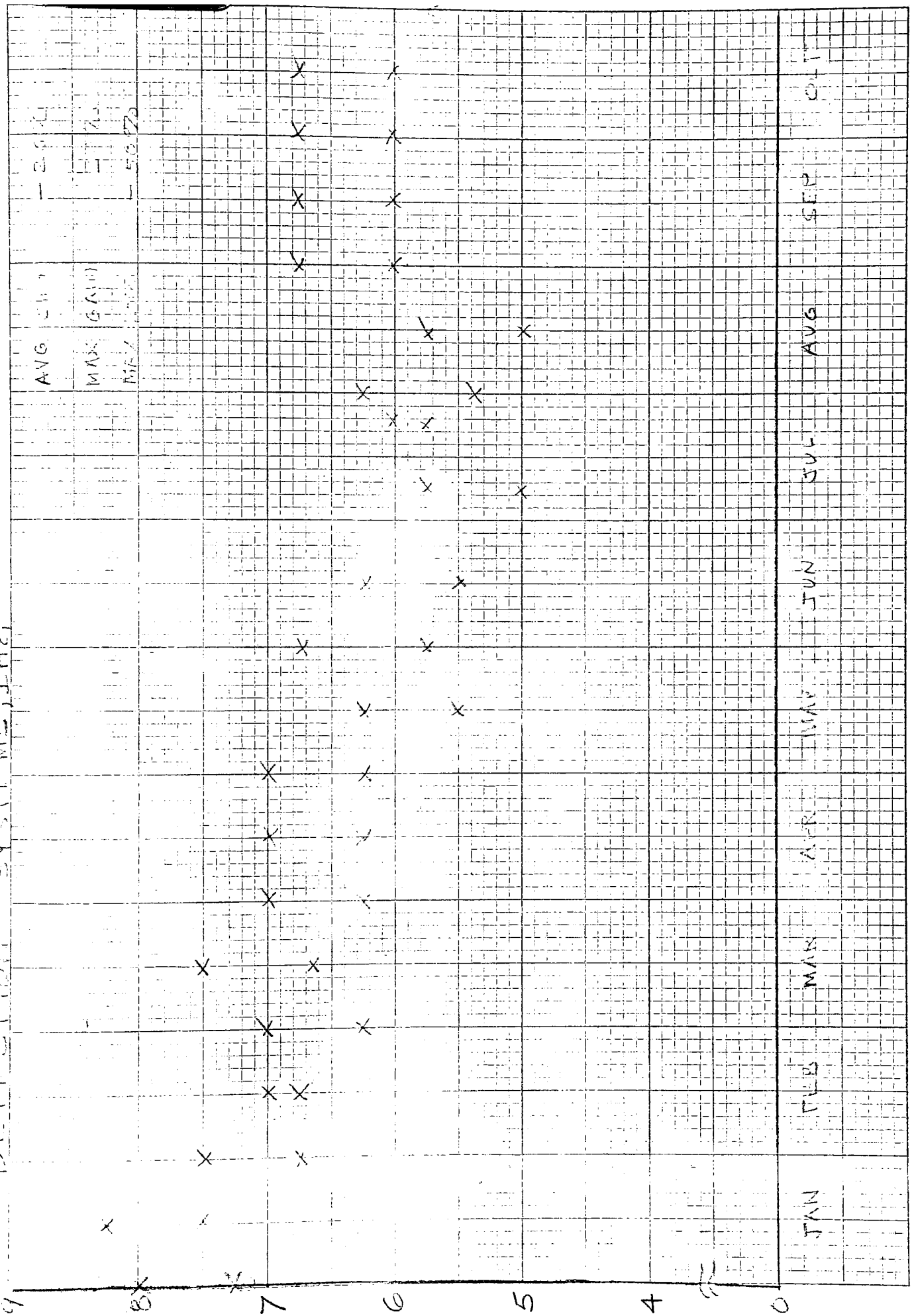
AVC 0.75
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 MAX LOSS 1.0

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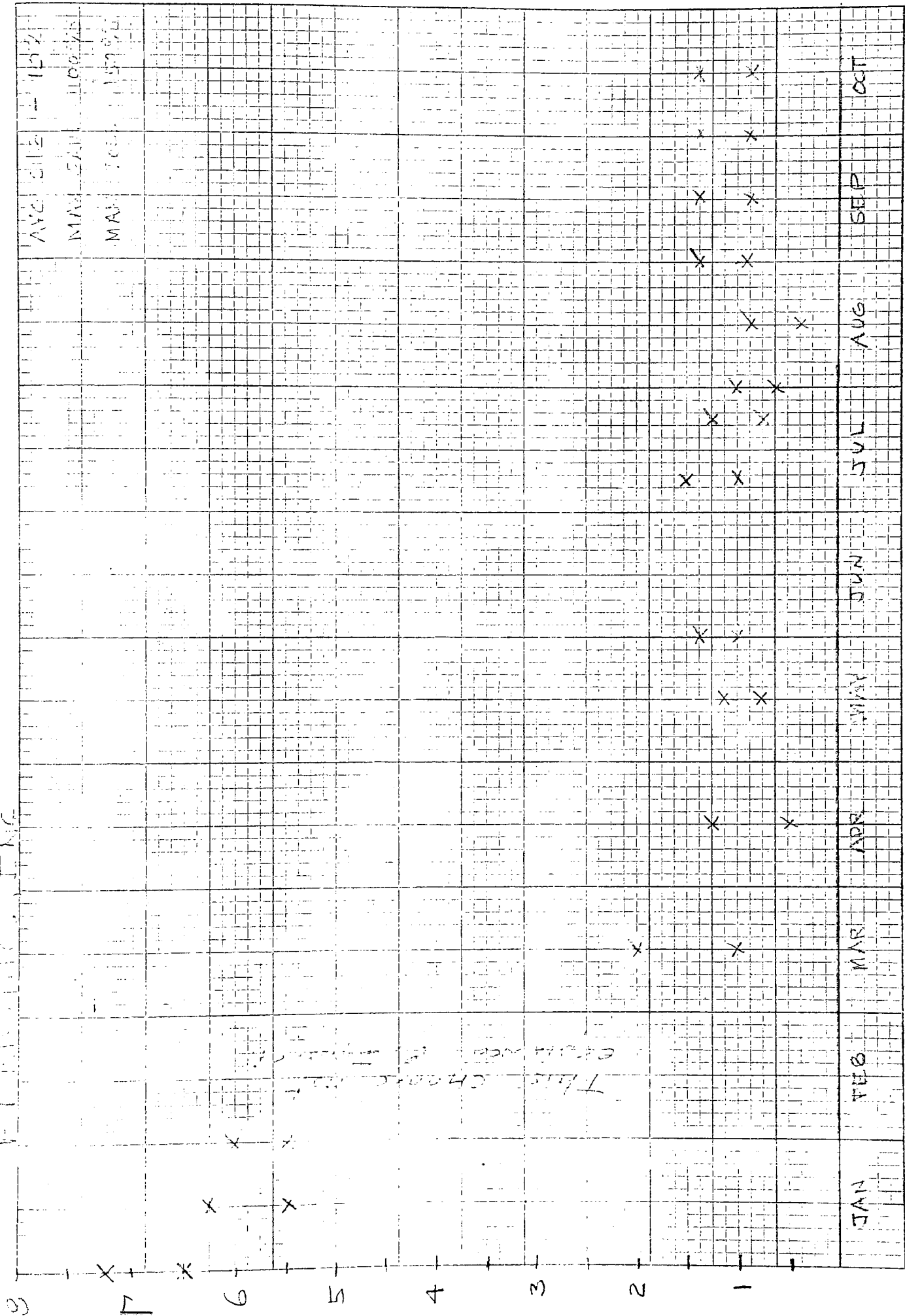


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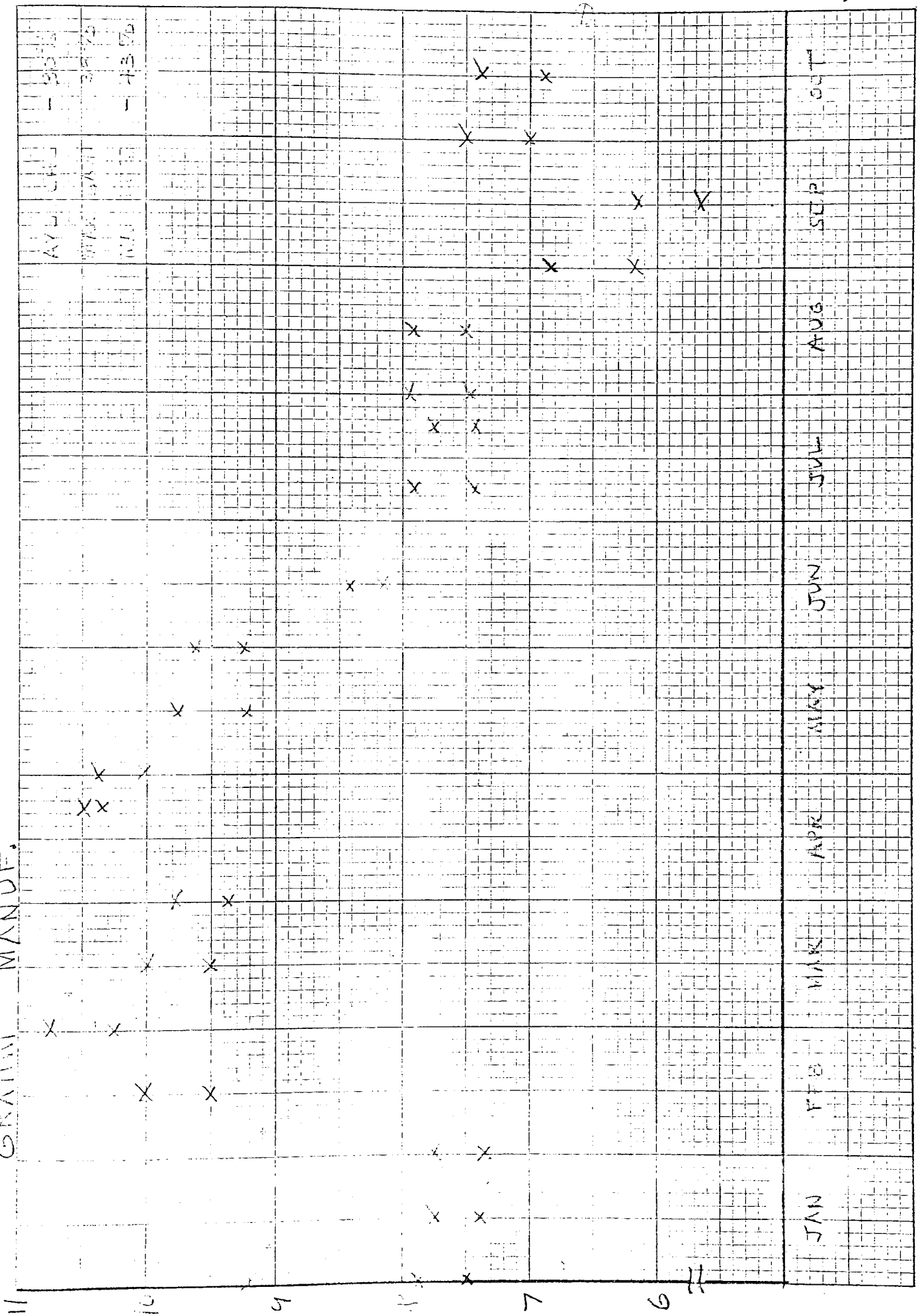
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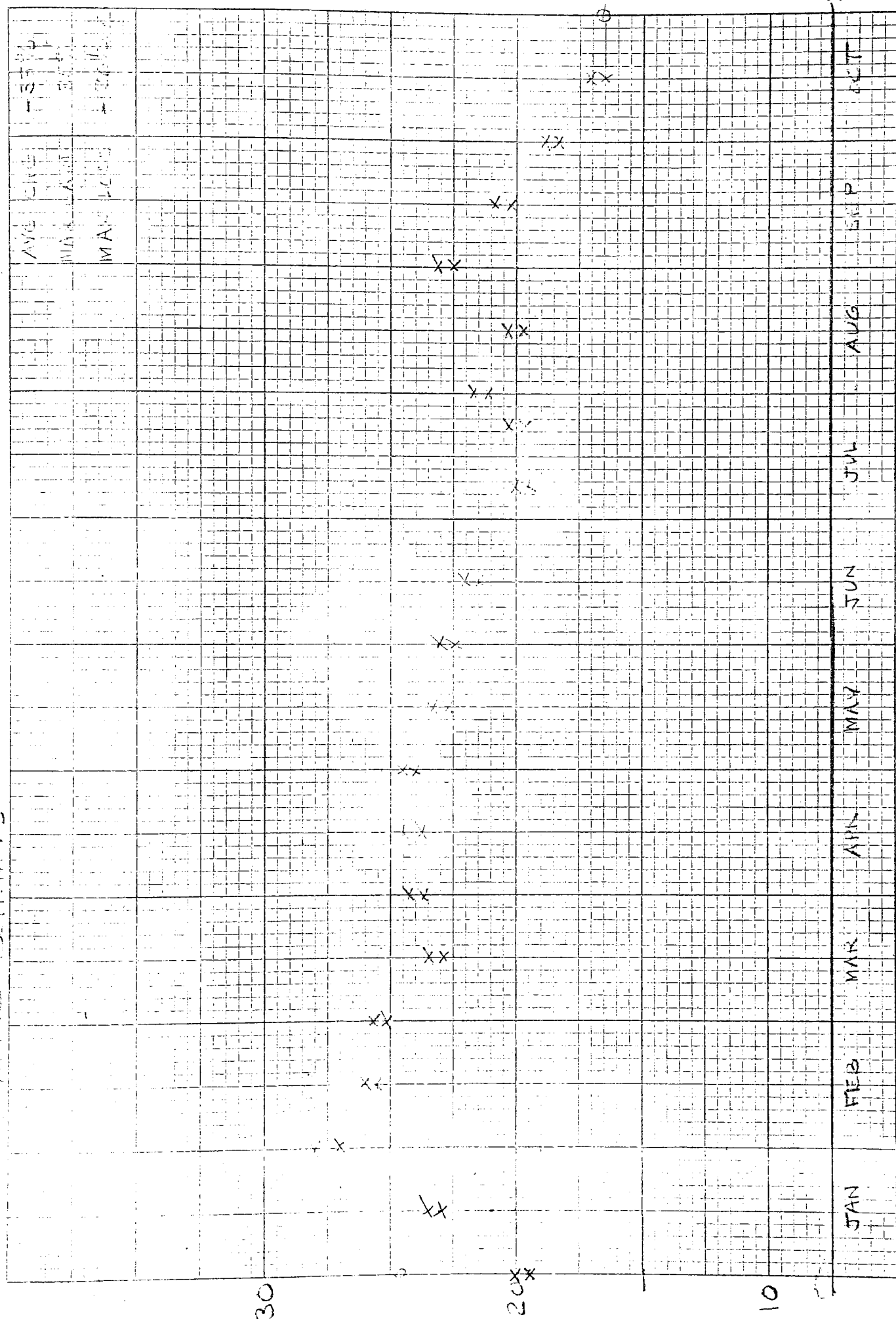
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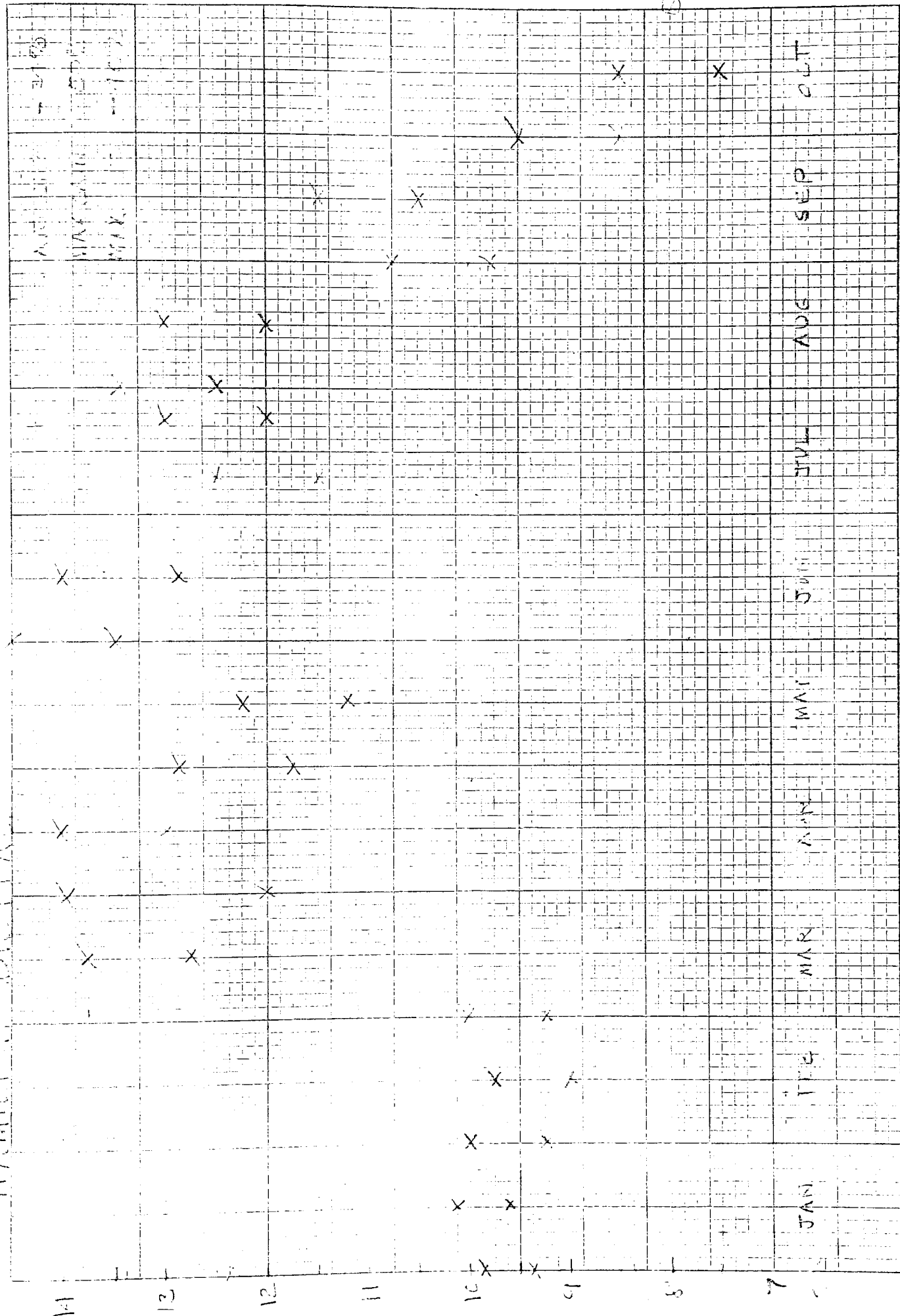


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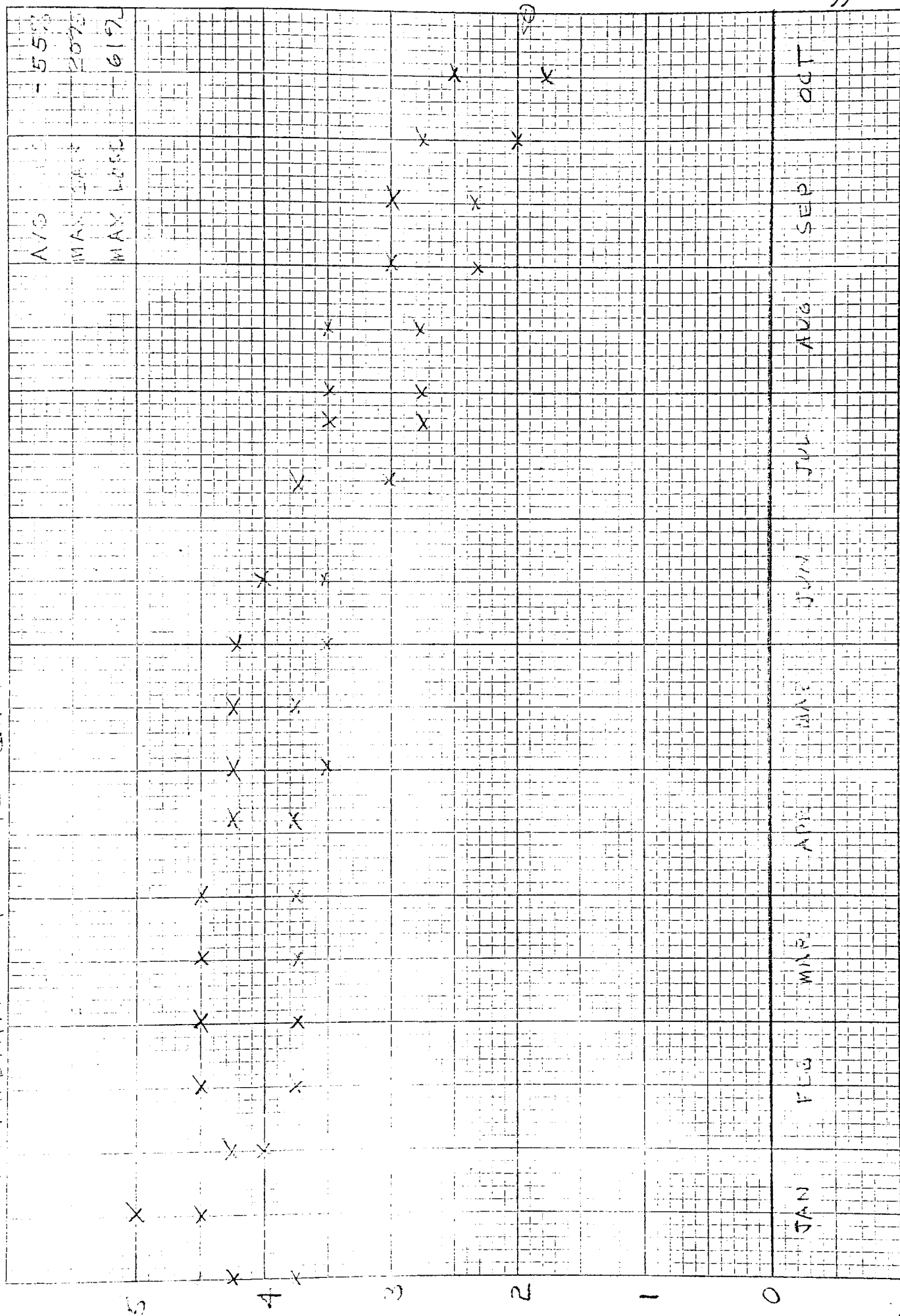
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HEUFFEL & ESTER CO.

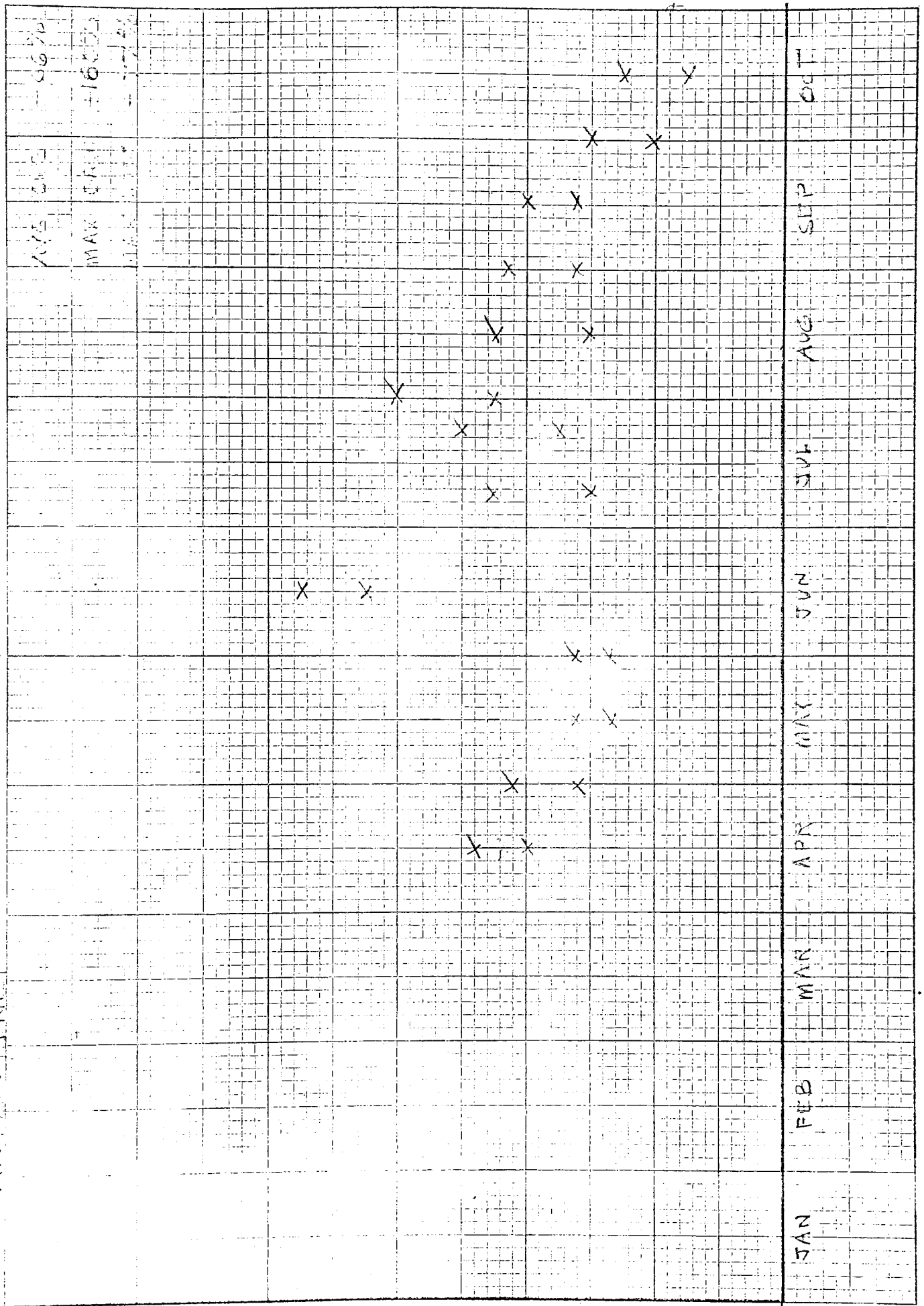


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 REUTHER & ESTER CO.

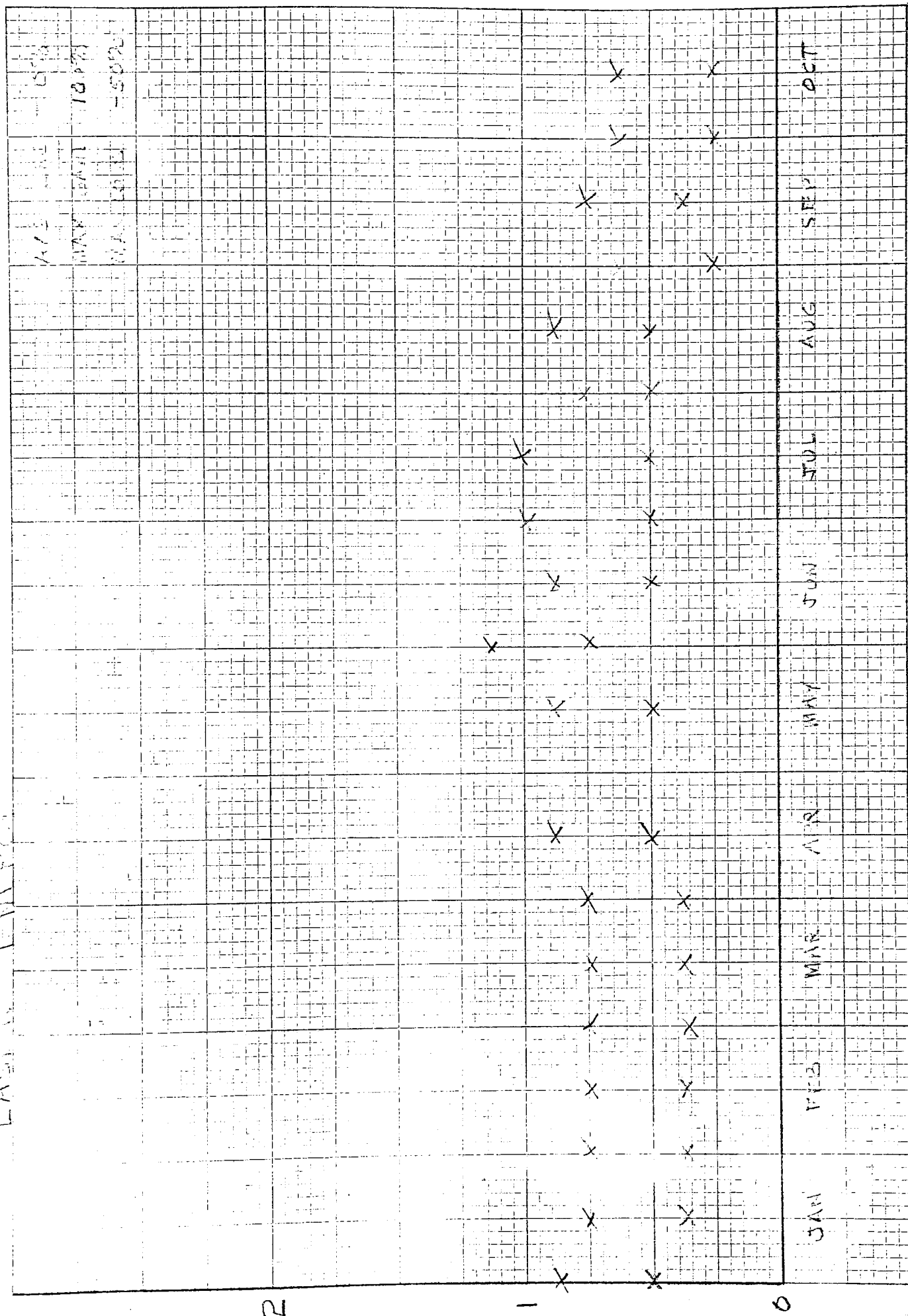
INFO DATA - COWEELS, INC.



KAYE X, INC.



LASER ENVELOPE



MARBLE RESOURCES

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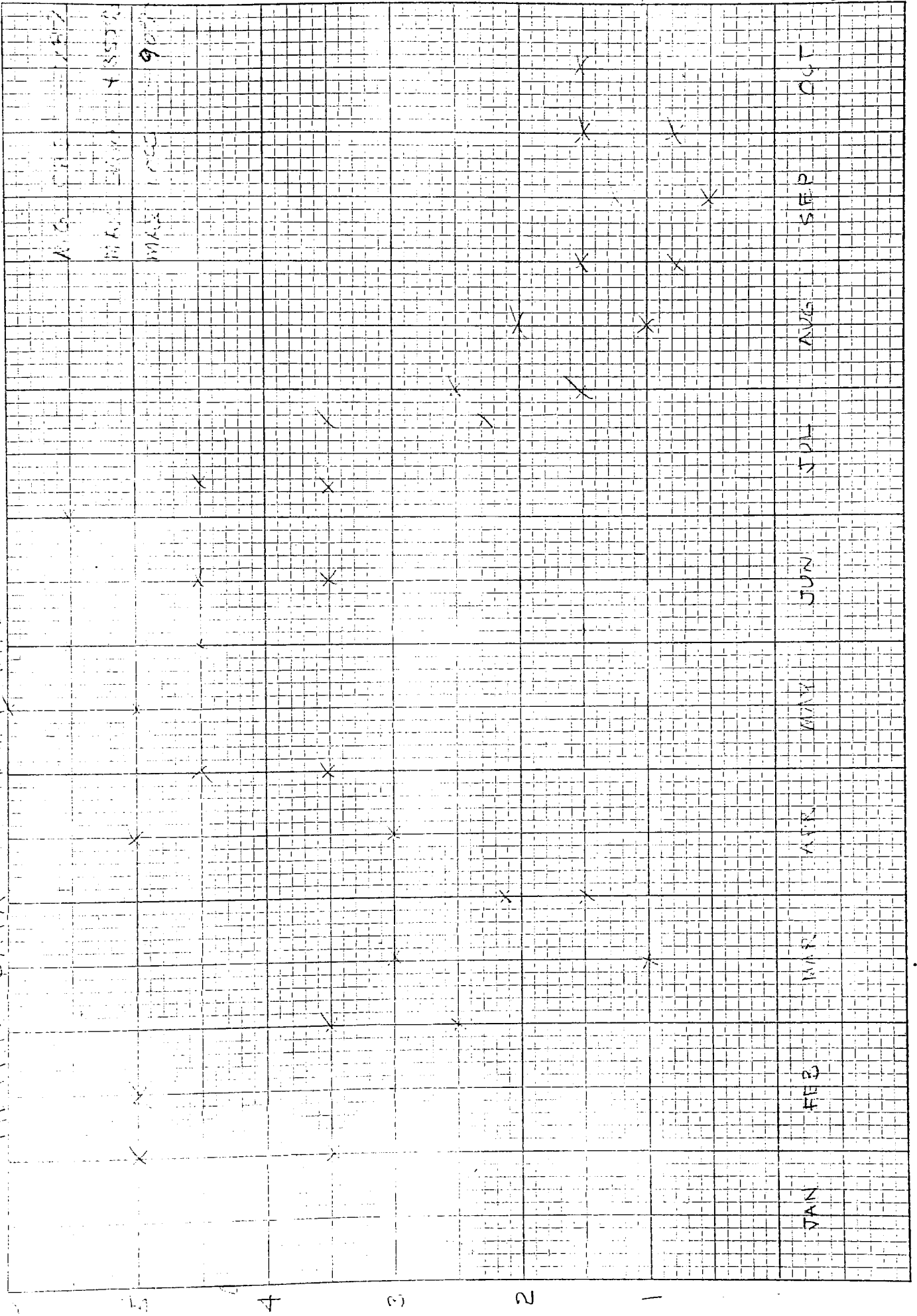
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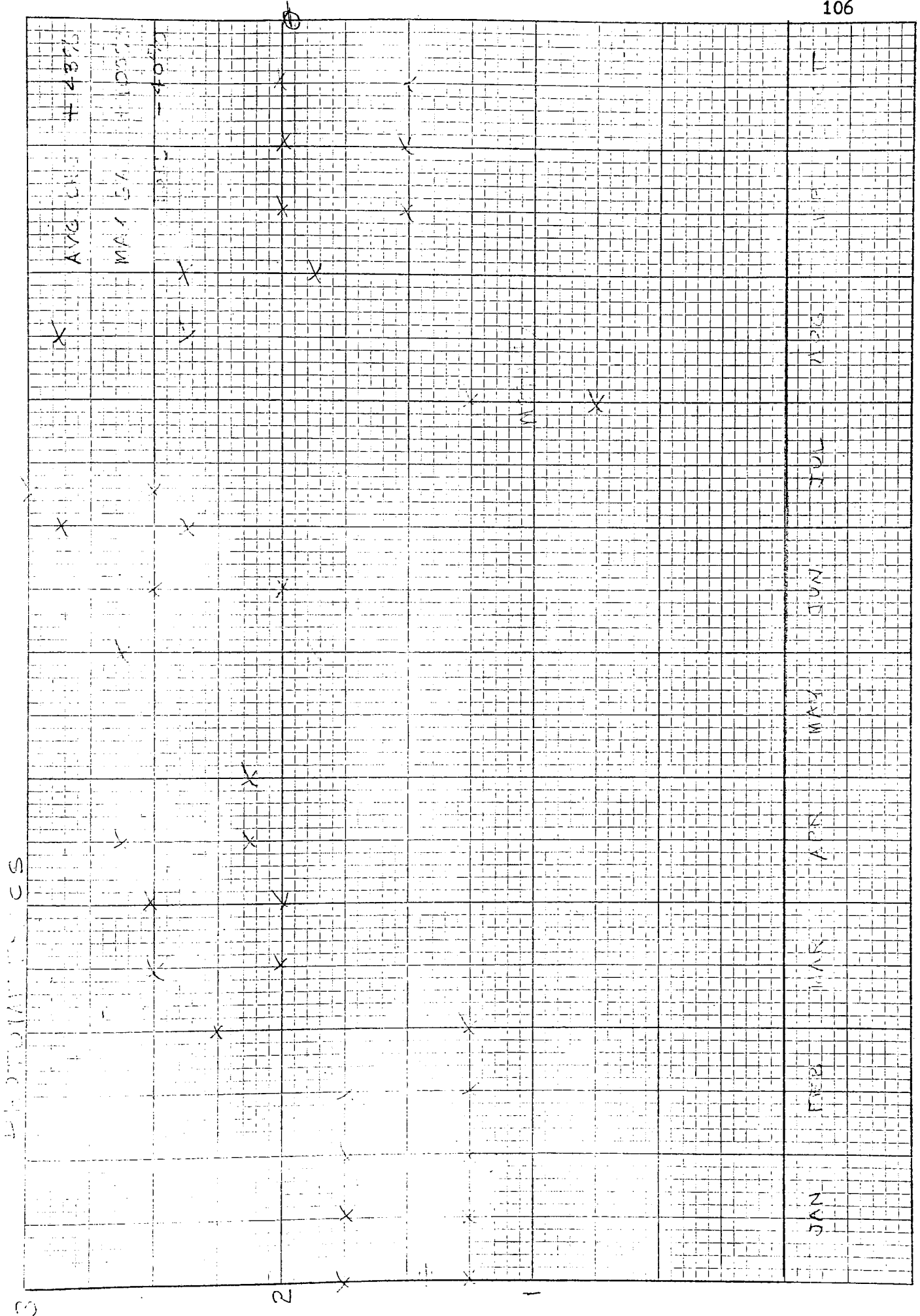
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MONTHLY DATA OF WATER



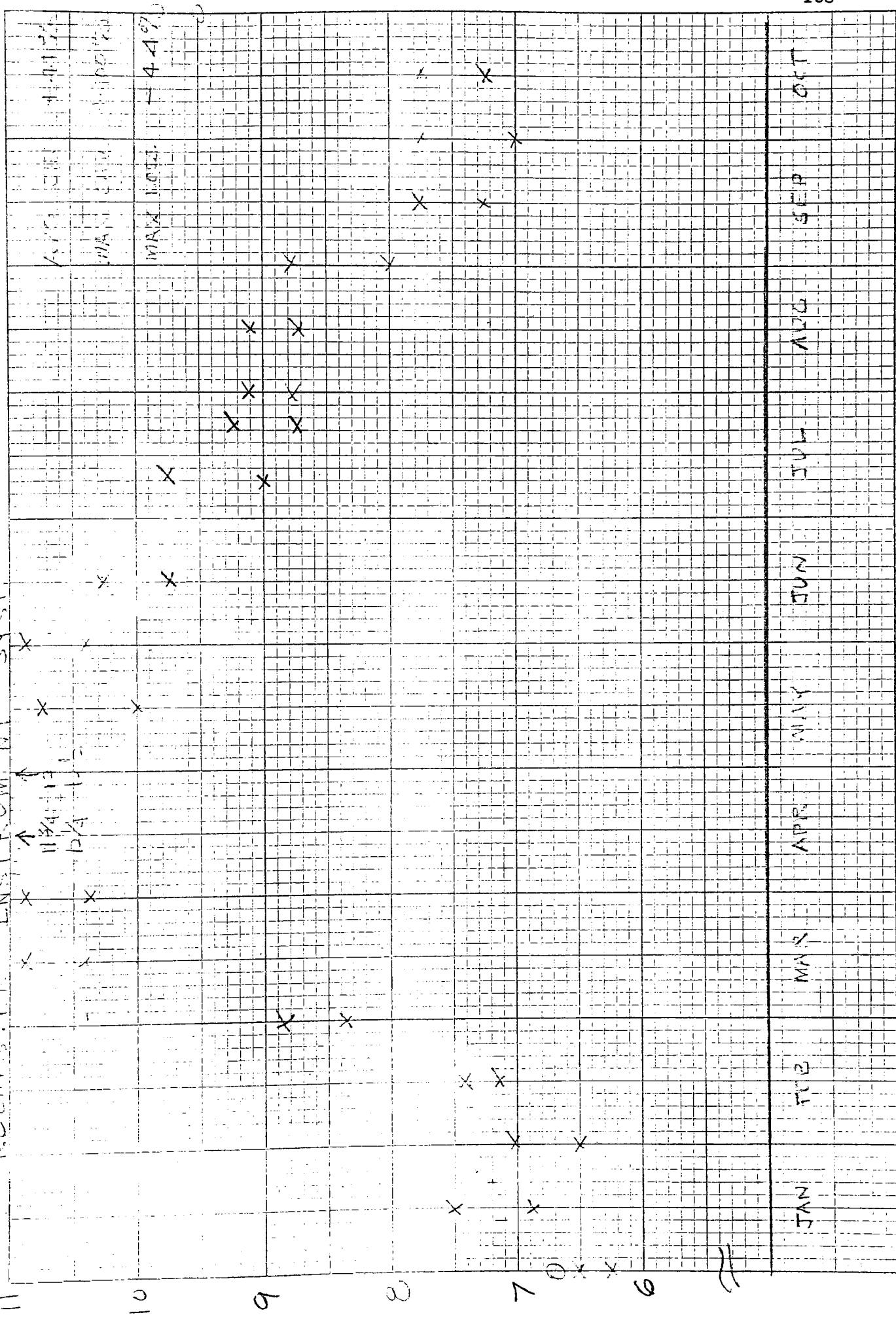


RD PRODUCTS, INC.

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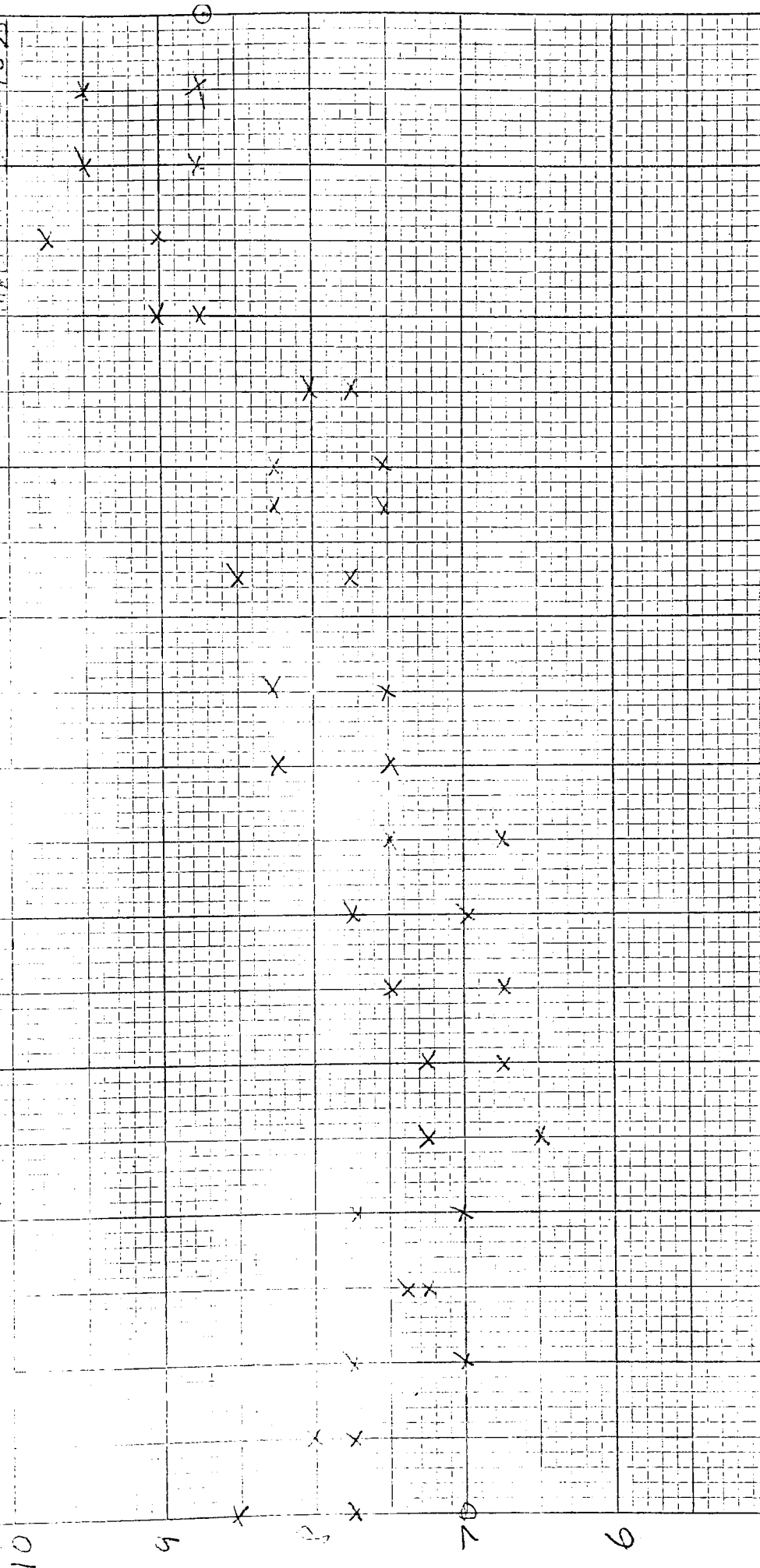
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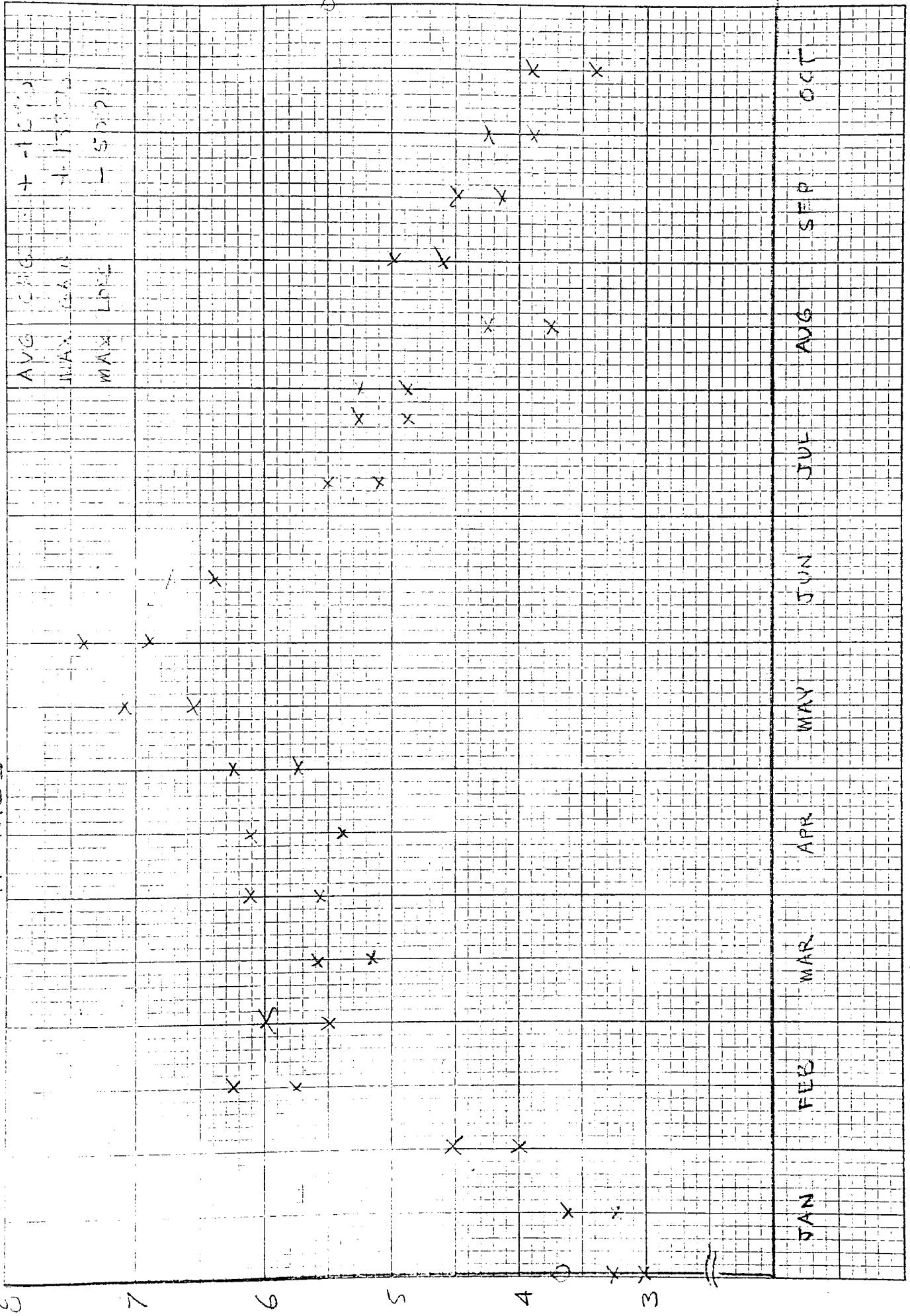


SCIENTIFIC RADIO, INC.

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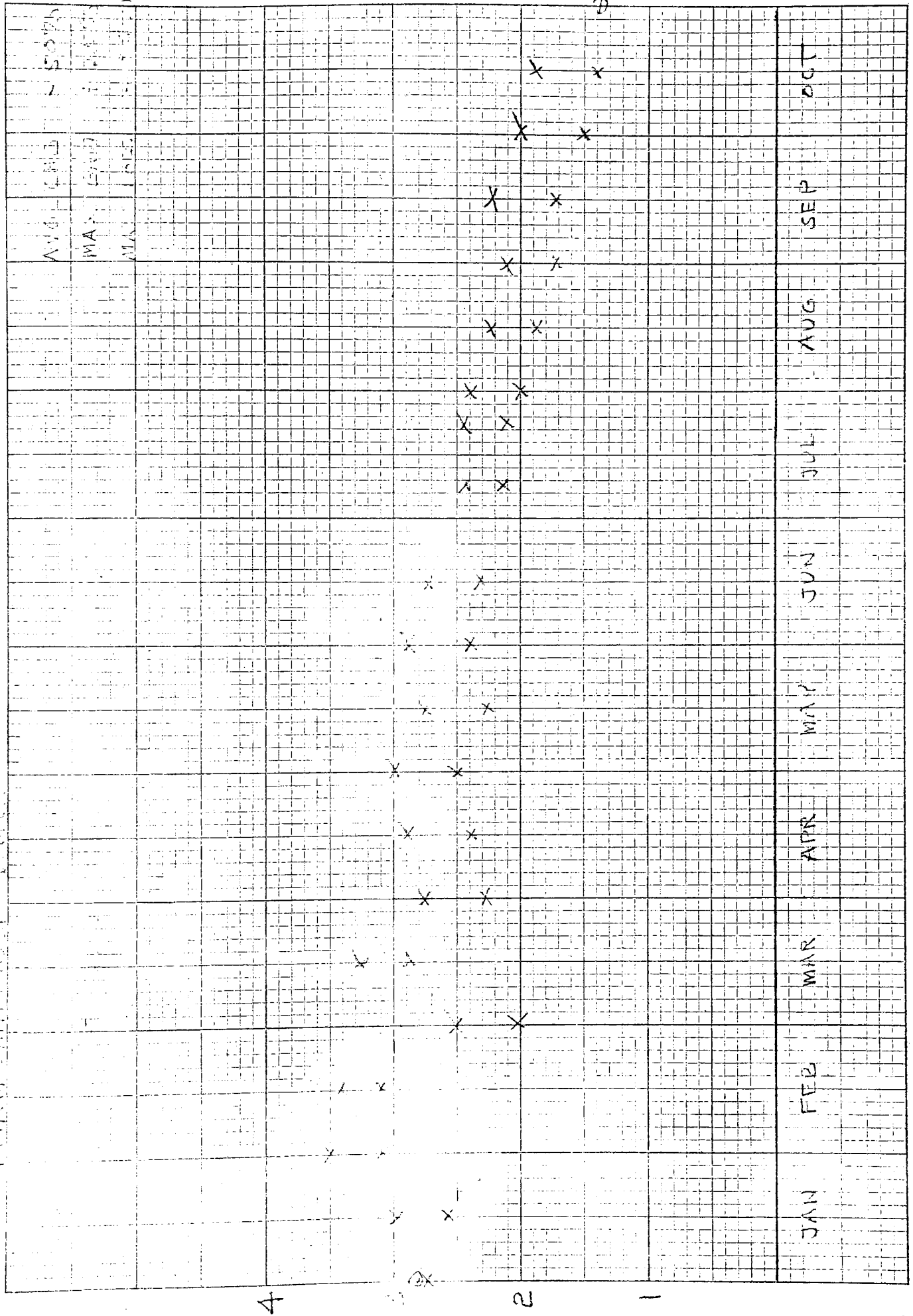
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APPENDIX D

COMPUTER PROGRAM AND LISTED RESULTS

The computer printout that follows is an abbreviated version of that described in the Chapter V flow chart. It takes the matrix for estimated product profits, costs, and life and the matrix for their respective probabilities of occurrence and separates the data for all 243 possible outcomes. It operates on each set of data and prints out the internal rate of return, probability of occurrence of that rate of return and a reference number for the data selected.

TY1-29

```

1.000 C      B. R. ROBINSON - A CAPITAL BUDGETING MODEL
2.000      DIMENSION A(3), B(3), C(3), D(3), E(3), V(3), X(3)
2.500      DIMENSION W(3), Y(3), Z(3), RRF(243), P(243)
3.000      DIMENSION PX(100), CP(100)
4.000      11  FORMAT (F10.2)
4.500      13  FORMAT (4F10.5)
5.000      10  READ (5, 11) (A(J), B(J), C(J), D(J), E(J),
5.200      1 J = 1, 3)
5.500      12  READ (5, 11) (V(J), W(J), X(J), Y(J), Z(J),
5.700      1 J = 1, 3)
5.950      I = 1
6.000      DO 105 J = 1, 3
7.000      BA = A(J)
7.500      BV = V(J)
8.000      DO 105 JA = 1, 3
9.000      BB = B(JA)
9.500      BW = W(JA)
10.000     DO 105 JB = 1, 3
11.000     BC = C(JB)
11.500     BX = X(JB)
12.000     DO 105 JC = 1, 3
13.000     BD = D(JC)
13.500     BY = Y(JC)
14.000     DO 105 JD = 1, 3
15.000     BE = E(JD)
15.500     BZ = Z(JD)
16.500     RR = 0
16.700     N = 0
17.000     106 CONTINUE
17.200     N = N + 1
17.500     IF (N - 200) 109, 109, 107
18.000     109 RR = RR + .5
18.200     EA = 0
18.400     EB = 0
18.500     LD = BD
19.000     DO 108 L = 1, LD
20.000     EA = EA + (BA - BB) / (1 + RR/100)**L
21.000     108 CONTINUE
22.000     EB = EA + (BC / (1 + RR/100)**BD)
23.000     IF ( EB .GE. BE ) GO TO 106
24.000     107 RRF(I) = RR
25.000     P(I) = BV * BW * BX * BY * BZ
27.000     WRITE (3, 13) RRF(I), P(I), I
27.500     I = I + 1
28.000     105 CONTINUE
29.000     END

```


!
 BTM SYSTEM-B IS UP
 12/26/ '72 11:45
 !LOGIN: BA115348,ROBINSON
 ID= U
 GOOD DAY,BTM IS UP,PLEASE DELETE ALL OUTDATED FILES,TOM

!EDIT
 *EDIT DA7
 *IN20
 20.000 .2
 *

TY1-30
 1.000 25000.
 2.000 20000.
 3.000 1.
 4.000 2.
 5.000 40000.
 6.000 100000.
 7.000 50000.
 8.000 10000.
 9.000 5.
 10.000 100000.
 11.000 350000.
 12.000 100000.
 13.000 20000.
 14.000 10.
 15.000 150000.
 16.000 .1
 17.000 .2
 18.000 .3
 19.000 .1
 20.000 .2
 21.000 .7
 22.000 .6
 23.000 .4
 24.000 .8
 25.000 .75
 26.000 .2
 27.000 .2
 28.000 .3
 29.000 .1
 30.000 .05

*END

!EDIT
 *EDIT INTERNAL
 *IN17.5
 17.500 IF (N - 200) 109, 109, 107
 *IN20
 20.000 $EA = EA + (BA - BB) / (1 + RR/100)**L$

IFORTTRAN
 OPTIONS: BO
 EXTENDED FIV-H VERSION DOO

** END OF COMPILATION **

ILOAD
 ELEMENT FILES:
 OPTIONS:
 F:5 = DA7, IN
 F:3
 F:

SEV.LEV. = 0
 XEQ? Y

5000.000000000.00000	1.00000	.30000
.30000		
.50000	.00012	1.00000
.50000	.00045	2.00000
.50000	.00003	3.00000
.50000	.00096	4.00000
.50000	.00360	5.00000
.50000	.00024	6.00000
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.50000	.00003	9.00000
.50000	.00016	10.00000
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.50000	.00128	13.00000
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75.50000	.02520	86.00000
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100.00000	.02016	130.00000
43.50000	.07 560	131.00000
22.50000	.00504	132.00000
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31.50000	.00063	135.00000
.50000	.00084	136.00000
.50000	.00315	137.00000
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.50000	.00672	139.00000
.50000	.02520	140.00000
.50000	.00168	141.00000
.50000	.00084	142.00000
.50000	.00315	143.00000
.50000	.00021	144.00000
.50000	.00112	145.00000
.50000	.00420	146.00000
.50000	.00028	147.00000
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.50000	.03360	149.00000
.50000	.00224	150.00000
.50000	.00112	151.00000
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.50000	.00084	154.00000
.50000	.00315	155.00000
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100.00000	.00960	230.00000
100.00000	.00064	231.00000
100.00000	.00032	232.00000
100.00000	.00120	233.00000
100.00000	.00008	234.00000
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100.00000	.00090	236.00000
100.00000	.00006	237.00000
100.00000	.00192	238.00000
100.00000	.00720	239.00000
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100.00000	.00024	241.00000
100.00000	.00090	242.00000
100.00000	.00006	243.00000

APPENDIX E

CAPITAL PECULIARITIES OF THE NEW SMALL FIRM

The small new firm has several obvious financial peculiarities which include inside investors, the SBA, and the SBIC. The inside investor is usually considered part of the entrepreneurial group that originates the new venture. The SBA (Small Business Administration) is a government agency under the department of commerce which was established explicitly to aid small business. The SBIC (Small Business Investment Companies) are independent government backed investment companies established to provide venture capital to small businesses. Along with these, the new small firm starts with a serious lack of trade credit and is assumed a poor credit risk.

The initial capital for the new firm has been found to come largely from the original owner entrepreneur.¹ More specifically, about half the money used to start small businesses is supplied by the owners.² The owners and members of the original investing group are referred to as inside investors. This group is often issued stock at a considerable discount from those shares sold publicly to the non-controlling investors. These entrepreneurs expect some larger return on their investment which can be expressed as by constant K times the return expected by the outside investor. Also associated with such inside investors is the lack of flotation costs. Because of these factors the cost of capital from inside sources can be given by:

¹SBA, The Small Manufacturer and His Staff, p. 27.

²Ibid, p. 27.

$$\text{Inside } C_E = Kg$$

Where K = multiple due to higher expectations of inside investors

g = growth expectations of outside investor

The overall cost of capital expression should then be written as:

$$C_E = \text{Inside } C_E + \text{Outside } C_E$$

$$C_E = Kg + \frac{g}{1 - b}$$

Through interviews with several small businessmen it became evident that these insiders appear to be rather difficult to locate and prefer to remain in the background for obvious reasons.

There are distinct advantages for wealthy individuals to invest in small businesses that fall under the Internal Revenue Code Section 1244 rules. This code provides an asymmetrical tax advantage to the investor.³

"An investor in a high income tax bracket stands to retain 75% of his gains but lose after taxes only 35% of his gross losses if he is in the marginal tax bracket of 65%.⁴

Though of obvious value to the small firm raising capital, this asymmetrical relationship may perpetuate more problems than it benefits if the investors decide to write off their losses in the first few years of the firm's operation.

The Small Business Administration is a federal government agency established in 1953 by congress to help small businesses grow and prosper.⁵ Eligibility for SBA loans is specified as:

³Roland I. Robinson, Financing the Dynamic Small Firm, p. 23.

⁴Ibid, p. 23.

⁵SBA Publication OPl-6, February 1970, p. 2.

"Most businesses that are independently owned and operated and not dominant in their fields; that cannot obtain private financing on reasonable terms and are not eligible for financing from other Government agencies, and that qualify as "small" under SBA's size standards, which generally are based on dollar volume of business or number of employees."⁶

For a manufacturing firm the above book goes on to note that the firm must have less than 250 to 1,000 employees to qualify. The SBA will back up to 90% of a bank loan with bank interest rates limited to 8%. In some cases the SBA will provide half the loaned capital at a maximum $5\frac{1}{2}\%$ interest rate with the commercial bank providing the remaining funds. Loans of this type are limited to \$350,000 SBA share with a maximum 10 year maturity for construction loans and 6 year maturity for working capital.⁷ Collateral for these SBA loans may include:

"Real estate or chattel mortgage; assignment of warehouse receipts for marketable merchandise; assignment of certain type of contracts, guarantees or personal endorsements; in some instances assignment of current receivables and inventories stored in bonded or otherwise acceptable warehouse."⁸

The SBA through the above program is one of the lowest cost sources of debt capital to the new small business. Because of the loan guarantee program and the presumed high risk associated with the new small business it is apparent that commercial banks would prefer SBA backed loans to conventional loans. Since their resistance to conventional loans is one criterion for SBA

⁶SBA, "A Handbook of Small Business Finance," p. 68.

⁷Ibid, p. 69.

⁸Ibid, p. 69.

backed loans it further seems evident that SBA backed loans may be the only source of debt capital for the new small firm. If we consider the SBA backed loan as the sole practical source of debt capital which is obtainable at a maximum 8% rate we would have:*

$$C_D = 0.08 (1 - T_c)$$

The corporate tax (T_x) rate for small business depends on their income. If we assume that income during the first two years of operation is less than \$25,000 this tax rate would be 22%.

The corporation is taxed at a marginal rate of 48% on each dollar earned above \$25,000.⁹ However, if plowed back earnings are considered vital to the growth of the new firm and growth is the objective of the owners it seems reasonable to assume that capital budgeting techniques could be implemented during the first two years of operation to keep earnings less than \$25,000 and the marginal tax rate at 22% instead of 48%. This would produce an assumed cost of debt of:

$$C_D = 0.08 (1 - 0.22) = 6.3\%$$

This should be substantiated in the text of the research.

The Small Business Investment Companies are SBA backed sources of equity capital for small businesses established by the Small Business Investment Act of 1958.¹⁰ These are privately owned and profit motivated corporations operating under broad SBA guidelines and may invest up to 20% of their paid-in-capital plus surplus into any one small business. Currently there are

* Note: Some venture capital is often provided in the form of convertible bonds. However, the owners expectations will be considered equivalent of that of equity.

⁹J. Fred Weston, Managerial Finance.

¹⁰SBA A Handbook of Small Business Finance, p. 71.

288 SBIC's with 51 boasting equity of \$1 million or more and each specializing in some specific industrial group.¹¹

Trade credit for the new small business is often given at extremely high rates as mentioned earlier. Robert P. Hungate in *Interbusiness Financing: Economic Implications for Small Business* has isolated the factors which determine trade credit terms and these terms which effect strict or cash terms are:

- A. Small quantity purchased
- B. Industrial type buyer
- C. Weak credit rating
- D. Weak competition within the industry

All of these factors are likely to apply to the new, small, high technology, manufacturing firm considered in this paper and substantiate the initial assumptions that trade credit will not be used extensively initially.

¹¹David A. Loehning, Barrons, April 24, 1972, p. 3.